DIESEL POWER

AND D… …RTATION

CATERPILLAR TRACTOR CO.
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SPECIAL …

AUGUST, 1952

AUG 26 1952
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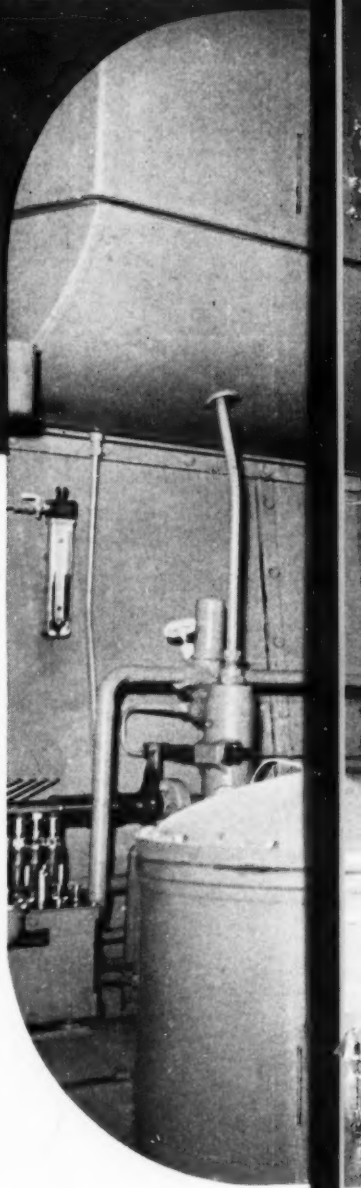
"For 20 Years, TEXACO DEPENDABLE DIESEL PERFORMANCE"

—Denton Smith,
Power Plant Superintendent,
Potash Company of America,
Carlsbad, New Mexico



Some twenty years ago, the Potash Company of America generated its electricity with only three Diesel engines – two of them lubricated with *Texaco Ursa Oil*. Today, this plant has eight Diesels and, because of superior performance over two decades, all of them are lubricated with *Texaco Ursa Oil*. Denton Smith, Power Plant Superintendent, thus speaks from experience when he says –

"Texaco Ursa Oils have done a real job for us in keeping our Diesels running clean, so that we've had a minimum of maintenance expense and very low fuel consumption over the years. This, plus the skilled lubrication engineering service rendered by The Texas Company, is the reason why we are using *Texaco Ursa Oils* exclusively today."

Texaco Ursa Oils have remarkable oxidation-resistance. Thus, they assure freedom from carbon and sludge formations . . . assure the free rings, clear ports and properly functioning valves that mean better compression and combustion . . . less fuel consumption . . . longer parts life and lower maintenance costs.

There is a complete line of *Texaco Ursa Oils* available to meet every requirement and approved by leading Diesel builders. Operators everywhere prefer them. In fact –

For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

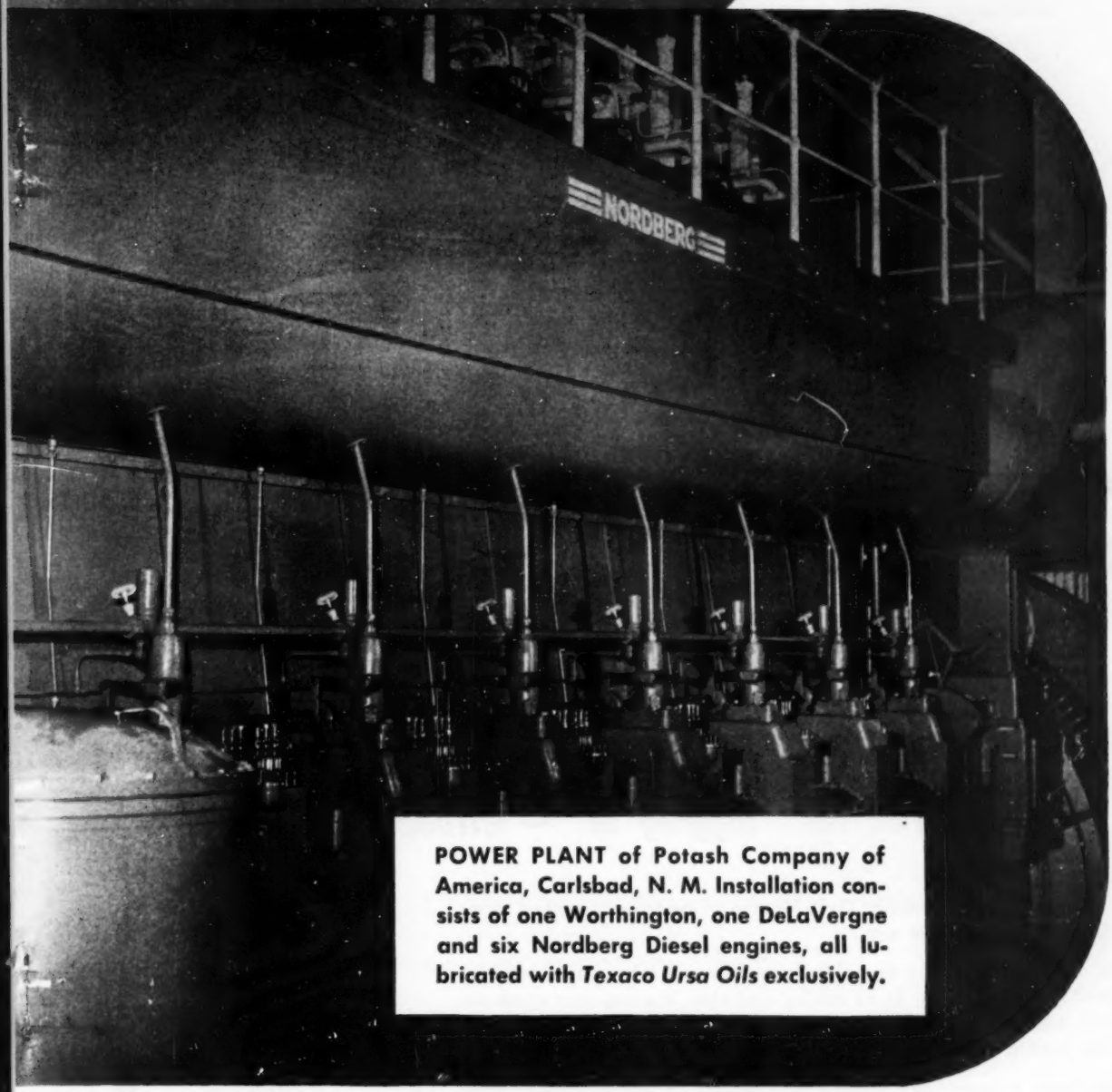
Let a Texaco Lubrication Engineer help you step up the performance of your Diesels and bring down your costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO

DIESEL POWER and DIESEL TRANSPORTATION for August 1952, Vol. XXX, No. 8. It is published monthly by Diesel Publications, Inc., Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Subscription rate: United States, $3.00 per year, single copies 35¢; Canada $4.00; Foreign $5.00 per year. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut under Act of March 3, 1879.

has given us



POWER PLANT of Potash Company of America, Carlsbad, N. M. Installation consists of one Worthington, one DeLaVergne and six Nordberg Diesel engines, all lubricated with *Texaco Ursa Oils* exclusively.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Faithfully yours 50 *for Fifty Years*

Another Example of Efficient Power at Lower Cost

This new Cooper-Bessemer-powered 200-W Bucyrus-Erie walking dragline, owned by Miami Crushed Stone Co., Miami, Fla., is shown digging unshot limerock from a 24-foot pit at the rate of 300 yards per hour. The engine is a dependable Cooper-Bessemer Type GS rated 385 bhp.

COOPER-BESSEMER DIESELS . . .

. . . noted for "digging in" — without complaint!

FOR example . . . President G. D. Monroe of the Miami Crushed Stone Company has this to say . . .

"This machine is digging an oolitic formation, and it is doing a good job without the rock having to be drilled and shot. We are very much delighted with the performance of your engine, and the whole machine for that matter."

If you have a power job coming up—mobile or stationary—Cooper-Bessemers can help you keep costs down, production up! They're designed and built that way. So get all the facts on these modern engines before going ahead with that next powering job of yours.

The **Cooper-Bessemer** *Corporation*

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

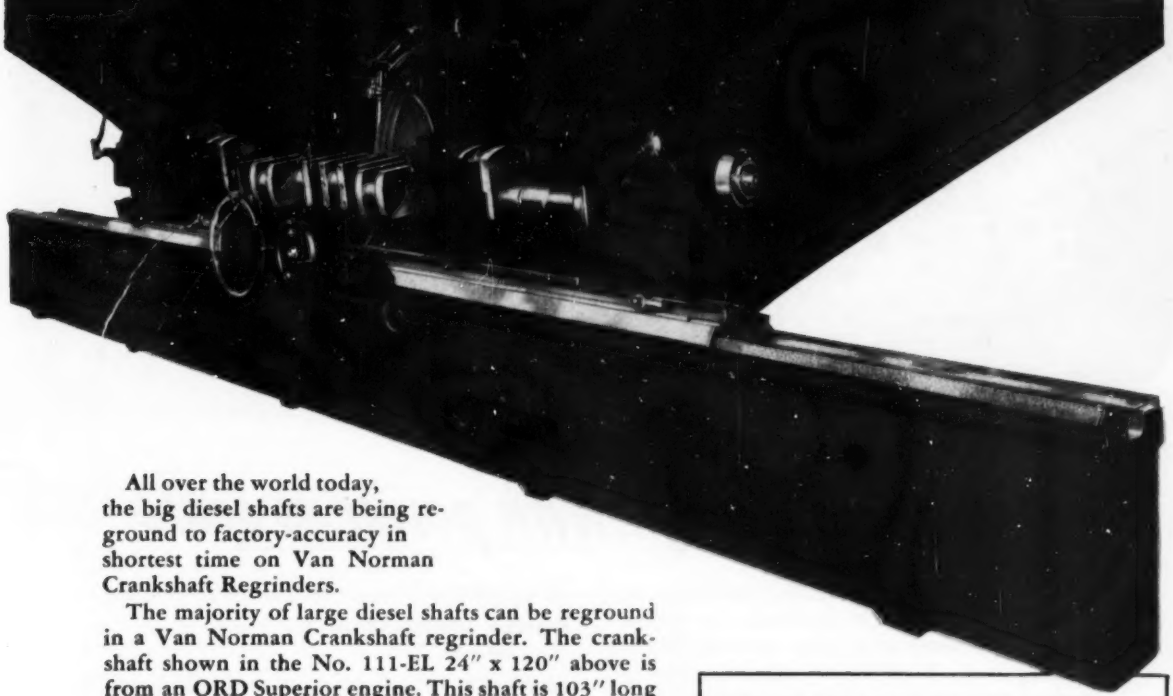
New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis
Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. Grove City, Penna.

Make More Money!

Grind Your Own Shafts with this

VAN NORMAN

No. 111-EL-34



All over the world today, the big diesel shafts are being reground to factory-accuracy in shortest time on Van Norman Crankshaft Regrinders.

The majority of large diesel shafts can be reground in a Van Norman Crankshaft regrinder. The crankshaft shown in the No. 111-EL 24" x 120" above is from an ORD Superior engine. This shaft is 103" long and has a 10½" stroke.

The heavy-duty, well-ribbed, hand-scraped, cast iron base plus the many other high quality precision machine tool features assure accuracy throughout many years.

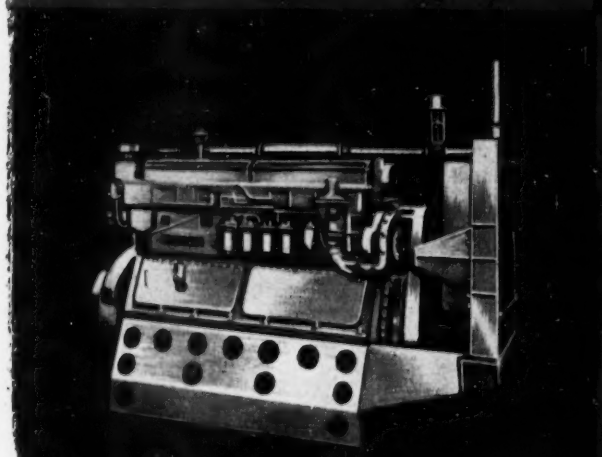
Get in on the big money to be saved in grinding these big shafts. WRITE FOR FULL DETAILS AND PRICES TODAY! Van Norman Co., Springfield 7, Mass.

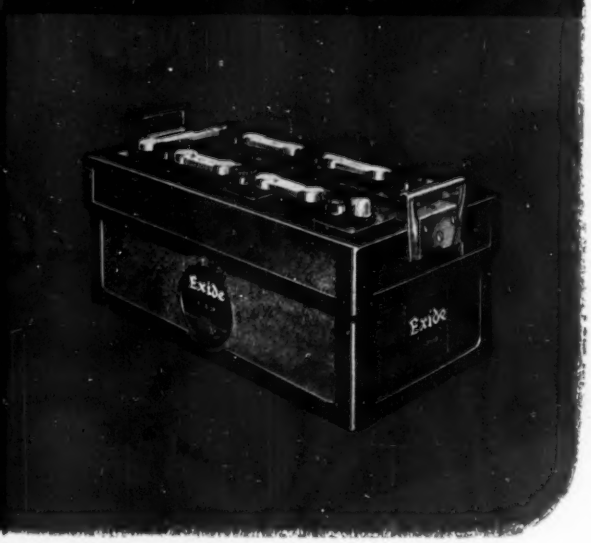
VAN NORMAN BUILDS 3 EXTRA-LARGE REGRINDERS:

No. 111, for shafts 84" long, 24" swing
No. 111-EL-24x120", for shafts 120" long, 26" swing
No. 111-EL-34x130", for shafts 130" long, 34" swing

The Best-Equipped Shop Gets the Business! that's why *"It Pays to Van Normanize"*

EXIDE STARTING POWER





Gets them going...with power to spare

You can always count on Exide Diesel-Starting Batteries. They're built specifically for the job . . . built to meet your most exacting diesel-battery needs. Their mighty starting power is proved daily by tough and rugged laboratory tests that never cease . . . by constant field checking . . . by reports of builders and users of diesel-powered equipment of every kind. In Exide Diesel-Starting Batteries you get:

QUICK BREAKAWAY and fast acceleration of engine to firing speed.

LOW DEPRECIATION due to their extra long life.

RUGGED CONSTRUCTION for rough usage in hard service.

LOW COSTS of operation and maintenance.

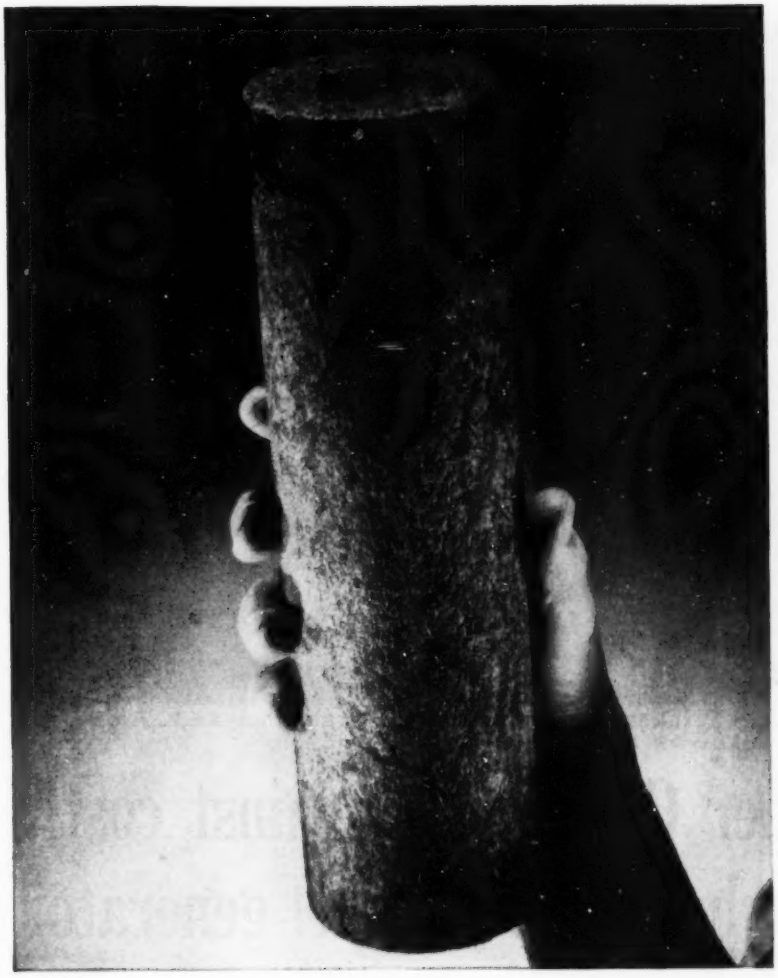
Use Exide Diesel-Starting Batteries for all heavy-duty services—in buses, trucks, tractors, off-the-highway equipment, ships, power plants, diesel-electric locomotives.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

WHEN IT'S AN Exide YOUR DIESELS START

"Exide" *Reg. Trade-mark U.S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952



The Simplest Filter Cartridge Lasts the Longest...Twice as Long

Cartridge renewals are cut at least *in half* when Cuno MICRO-KLEAN replaces any other filter. And throughout its service life, MICRO-KLEAN is *guaranteed* for specific performance.

CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

The Diesel is a Simpler Engine . . . Here's the Simplest Filter

There is nothing complicated about the Cuno MICRO-KLEAN filter, and it fits the requirements of Diesel fuel and lube better than any other filter on the market.

The MICRO-KLEAN is *all filter*—a single, compact structure of "felted" fibres with no internal or external supports to take up space and complicate installation.

The cartridge is mechanically strong due to resinous impregnation and polymerization. It works "mechanically" that is, merely by *obstructing* passage of impurities, rather than by absorption or chemically. It neither removes additives, nor is affected itself by crankcase acids, moisture or other damaging agents. It won't swell or shrink, soften or harden, rupture or channel —or otherwise become distorted to restrict flow or release contaminants to clog injectors or damage parts being lubricated.

Seven Times Longer Life

A railroad, testing competitive makes for its locomotive fuel lines, found MICRO-KLEAN life seven times longer! MICRO-KLEAN gets this greater dirt capacity from its maximum porosity (85-90%) and from its exclusive "graded density in depth", permitting smaller particles to penetrate further, rather than "loading" the surface.

Cuno MICRO-KLEAN, on Diesel fuel or lube, is guaranteed to remove 100% of all solids for which it is rated*, plus a large percentage down to 1 micron.

*10,25,50 microns. Capacities: from a few to over 800 gpm.

CUNO ENGINEERING CORPORATION
Dept. 255C, South Vine Street, Meriden, Conn.

Please send information on Cuno MICRO-KLEAN for Diesel service.

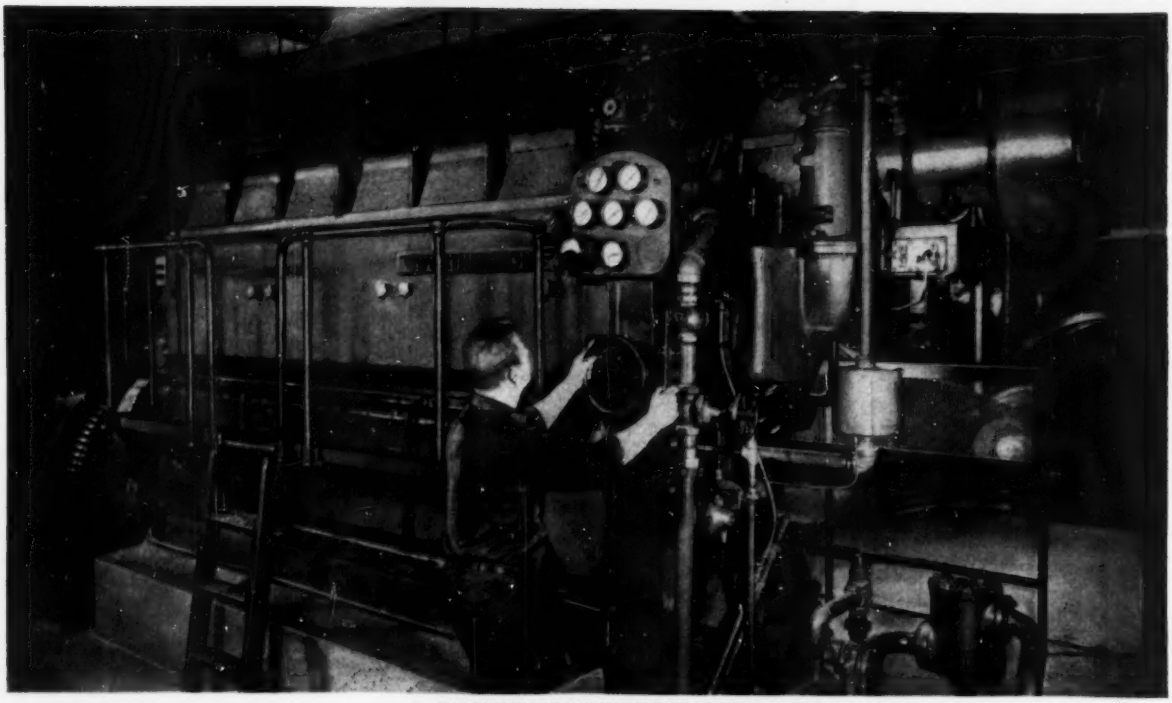
Name.....Title.....

Company.....

Address.....

City.....Zone....State.....

Please attach to business letterhead



WORTHINGTON SUPERCHARGED DIESEL ENGINE at Kalamazoo Paper Co., Kalamazoo, Michigan, driving 600-kw generator.

Kalamazoo Paper Co. guards against costly shutdowns with heavy-duty diesel generator

Company installs Worthington supercharged diesel and 600-kw generator for stand-by

An insurance policy against costly shutdowns! Such is the attitude of Kalamazoo Paper Company management towards the Worthington medium-speed heavy-duty diesel they've installed for stand-by service.

Reason for their choice of this large heavy-duty unit was the reputation for absolute dependability that has been built up for these rugged Worthington engines over a period of years.

Let's look at some of the time-tested features that insure this dependability:

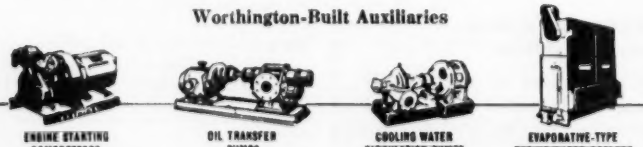
1. *Heavy cast-iron base and frame.*
2. *Steel forged crankshaft bedded in base.*
3. *Gear-driven camshaft.*
4. *Metal-to-metal fit between cylinder heads and liners.*
5. *Main bearings lubricated at bottom where pressure is greatest.*
6. *4-bolt connecting-rod bearing assembly.*

An insurance policy can be no better than the company that backs it. That's why before you buy, it will pay you to look carefully into the manufacturer's reputation.

It is by serving customers such as Kalamazoo that Worthington through the years has built a reputation for manufacturing long-lived, dependable equipment—a reputation that is backed in the heavy diesel field by the *longest experience* of any manufacturer of this type of equipment.

Feel free to call on Worthington for further details on diesel performance. We can meet all your engine requirements—oil, gas, or "dual fuel". Write, stating your requirements, to Worthington Corporation, Engine Division, Buffalo, New York.

Worthington-Built Auxiliaries

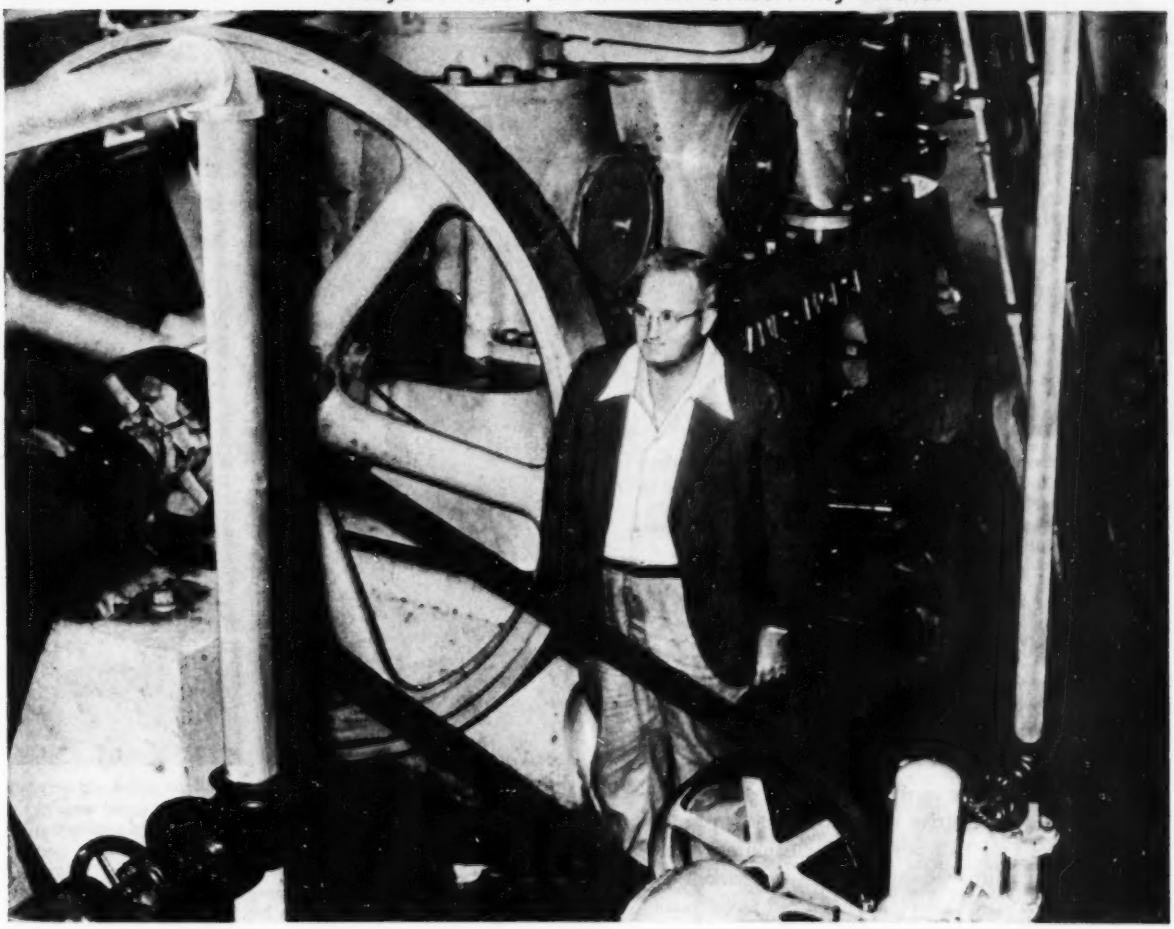


Economical Continuous Power— Diesel Engines, 150 to 2,640 hp . . . Gas Engines, 190 to 2,880 hp . . . Dual Fuel Engines, 150 to 2,640 hp.

WORTHINGTON
Engines

Dependable Diesel Power is a Must in The Everglades

...Says Bill Allen, South Florida Conservancy District



"We can't afford stuck rings or carbon here in the Lake Okeechobee area. From May through November, diesel pumps must handle an enormous rainfall – and dependable 24-hour operation is *essential* to the success of our crops."

Mr. Allen adds, "18 years ago, we changed to Sinclair GASCON Oil. It eliminated our problem of sticking rings and carbon deposits in the exhaust ports. We've used this product together with Sinclair Diesel Fuel exclusively for all these years. Our diesels thrive on this combination – we're more than satisfied with Sinclair."

Why don't you, too, change to GASCON® Oil? Give it the chance to help cut maintenance while adding dependability to your diesels. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N.Y.

SINCLAIR DIESEL LUBRICANTS

Make LINK-BELT your headquarters for diesel drives

To utilize the best features of each type chain in converting this steam operated locomotive crane to a dieselized unit, the primary drive uses Link-Belt Silverstreak Silent Chain and the secondary drive uses Precision Steel Roller Chain. Also shown, both above and at right, Link-Belt Roller Bearing Pillow Blocks.

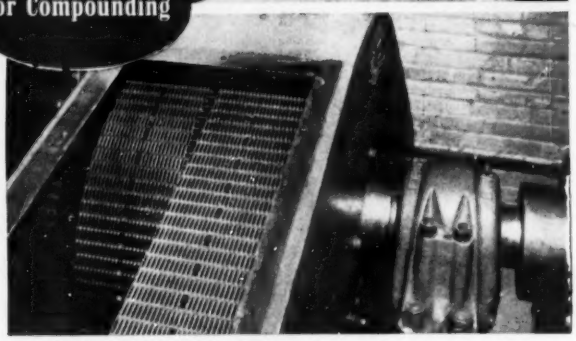
Get the right chain for your requirements from the complete LINK-BELT line

Whether it's one of the applications shown here — or any other drive job — you'll find it pays to call in a Link-Belt power transmission engineer. Working with a complete line and backed by Link-Belt's broad experience, he can recommend the *one* drive that best meets your exact requirements. For engineering assistance, call the Link-Belt office near you.

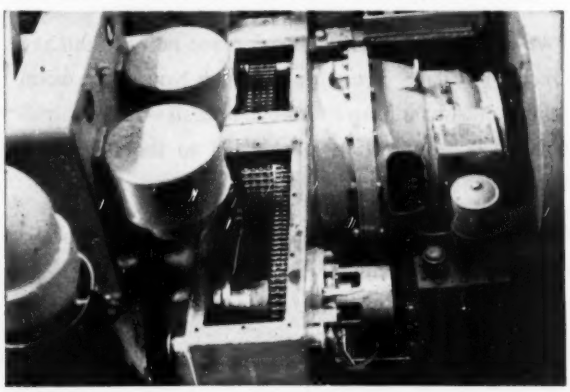
LINK-BELT

CHAIN DRIVES

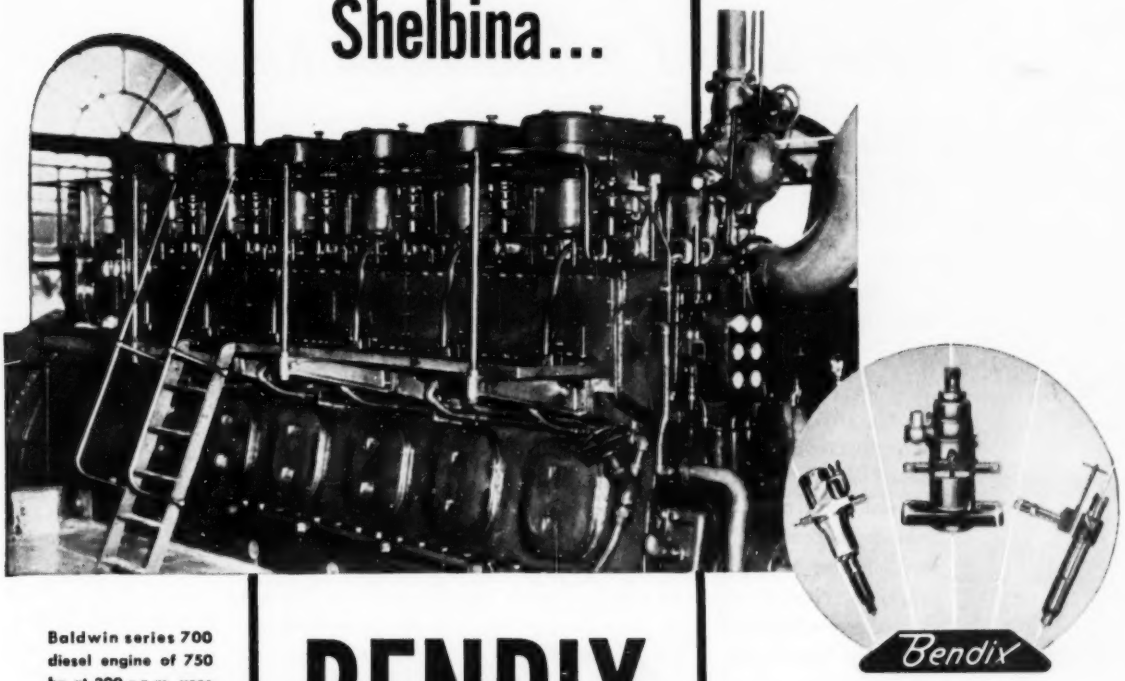
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, factory branch stores and distributors in principal cities. 12,798



To increase flexibility and portability and to speed delivery, many operators today use two or more smaller diesel engines instead of one larger engine of comparable hp. The application above uses Link-Belt Silverstreak Silent Chain to connect four 175 hp engines to the common generator drive shaft. Below: Link-Belt Roller Chain drives used for twinning engines. A series of six engines drives Ideco No. 711 oilwell drilling rig.



When They *Step up* Service in Shelbina...



Baldwin series 700 diesel engine of 750 hp at 300 r.p.m. uses Bendix Fuel Injection equipment.

BENDIX
FUEL INJECTION
and
BALDWIN
DIESEL ENGINES

Step in!

Municipal electric power has a 56 year history in Shelbina, Mo., a town of 2000 inhabitants, located about 100 miles northwest of St. Louis.

Diesel powered since 1932, the equipment used in Shelbina power plant has been progressively modernized to meet ever increasing capacity requirements. The latest addition is a Baldwin diesel series 700 with Bendix Fuel Pumps and Injection Equipment.

In the great advance that diesel power is making, Bendix fuel injection equipment, together with outstanding diesel engine manufacturers, is playing an increasingly important part.

SCINTILLA MAGNETO DIVISION of
SIDNEY, NEW YORK

Bendix
AVIATION CORPORATION

Export Sales: Bendix International Division,
72 Fifth Ave., New York 11, N.Y.
Western Market Office: 582 Market Street, San Francisco 4, Calif.

Koppers expands service on American Hammered

Industrial and Aircraft Piston Rings

BECAUSE of the sale of its automotive replacement piston ring business Koppers now is in a position to further increase its leadership in piston and sealing rings for aircraft, general industrial, marine, commercial engine, railroad and oil field applications.

To present and prospective users of Koppers American Hammered Industrial Rings, this means increased engineering service, through concentrated attention to the solution of industrial and aviation ring problems; and greater production capacity for both original equipment and replacement rings. Our available manufacturing facilities include:

A large foundry equipped for both static and centrifugal casting . . . a modern heat-treating plant . . . one of the largest and most up-to-date chromium plating plants . . . modern machine shops . . . an efficient engine test laboratory . . . a modern and complete piston ring research laboratory.

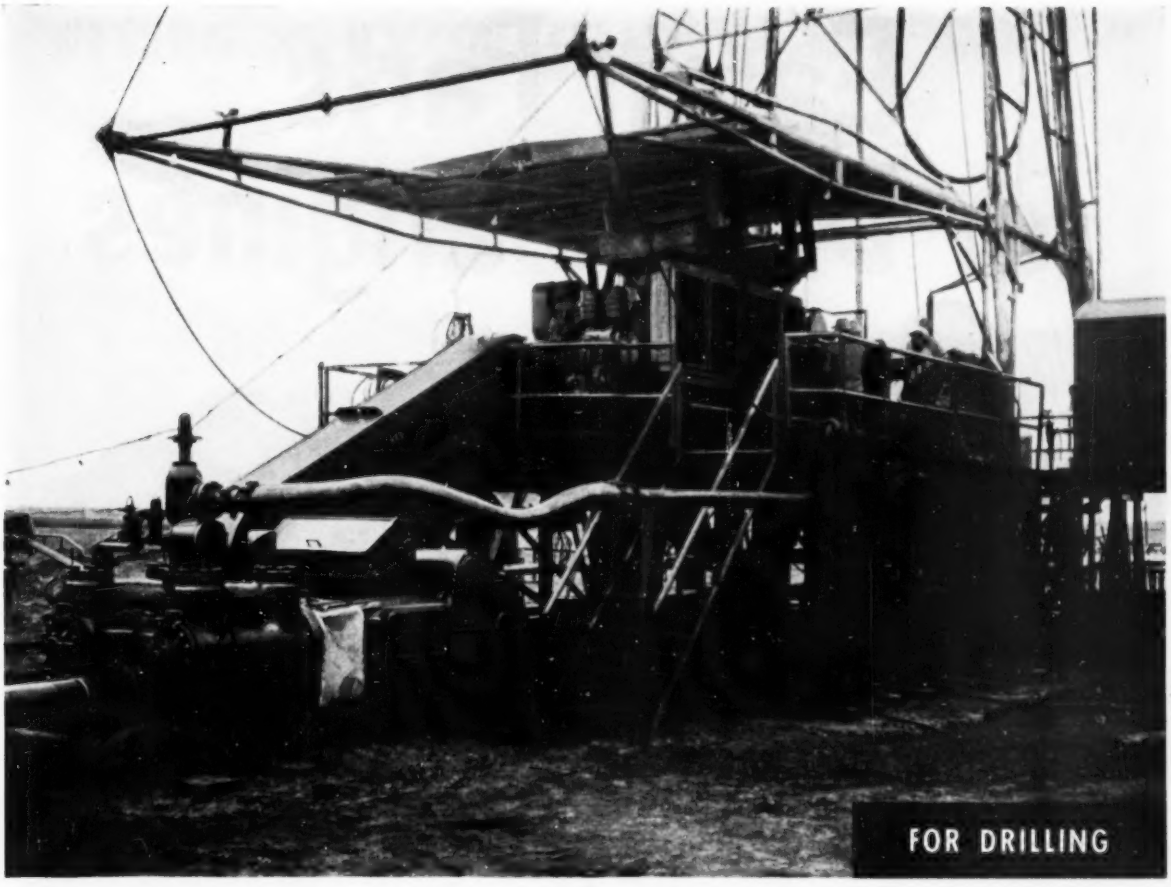
In industrial and aviation rings, American Hammered *means* Koppers . . . builders of *engineered* products for industry.

Write, wire or phone us for the right answer to your piston or sealing ring problems, today. KOPPERS COMPANY, INC., *Piston Ring Department*, 1548 Hamburg Street, Baltimore 3, Maryland.

KOPPERS®

Koppers American Hammered Industrial Piston Rings

Only KOPPERS *can furnish K-Spun® and Porous Chrome!*



THIS IS THE DIESEL

for any job from 32 H.P. up

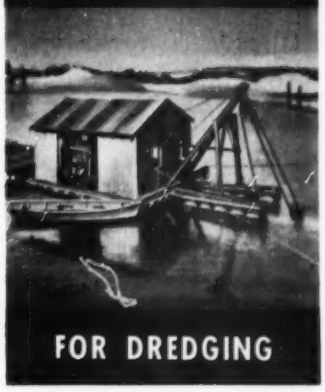
Here's the Diesel that has changed a lot of old ideas. It has brought new standards of economy and efficiency to scores of jobs where Diesels were never used before—down to operations requiring as little as 32 horsepower.

This General Motors Diesel packs more power in less space. It actually takes up little more room than gasoline engines of comparable horsepower—and is even simpler to operate.

It outworks other engines of its size because high compression 2-cycle operation makes it faster-accelerating, quicker to respond to varying loads.

It slashes costs! Besides traditional Diesel fuel economies, the GM Diesel engine costs less to maintain. *In applications where GM Diesels have replaced gasoline power, owners report savings of 40% to 70% on fuel and maintenance.*

Your GM Diesel distributor will gladly show you how this modern Diesel power can step up your production and cut your costs. You'll find it's available in more than 750 different models of machines. Ask him for the facts, or write us.



DETROIT DIESEL
ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN

Single Engines . . . 32 to 275 H.P. Multiple Units . . . Up to 800 H.P.

GM
GENERAL MOTORS
DIESEL POWER

Eaton Parts for Diesel Engines

have a background of years of cooperation with the Diesel industry

Eaton is proud to have served as supplier to leading Diesel engine manufacturers for many years—furnishing valves, free-valves, lash adjusters, valve seat inserts, cam followers, bolts, studs, and other precision parts. This close cooperation with the Diesel industry has given Eaton engineers a thorough understanding of the requirements of specific engines, so essential in solving valve-train and other problems.

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

SAGINAW DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

CITIES SERVICE OILS WORK ON

"The Longest, Toughest Truck Haul in the World!"

FROM DULUTH, MINN. TO FAIRBANKS, ALASKA . . . 7000 MILES ROUND TRIP PER MONTH . . . IN TEMPERATURES RANGING FROM 100 ABOVE TO 70 BELOW . . .

Albert Herda

...trucker extraordinary, uses Cities Service "C" Series Oil in year round operation.

CITIES SERVICE

Quality Petroleum Products

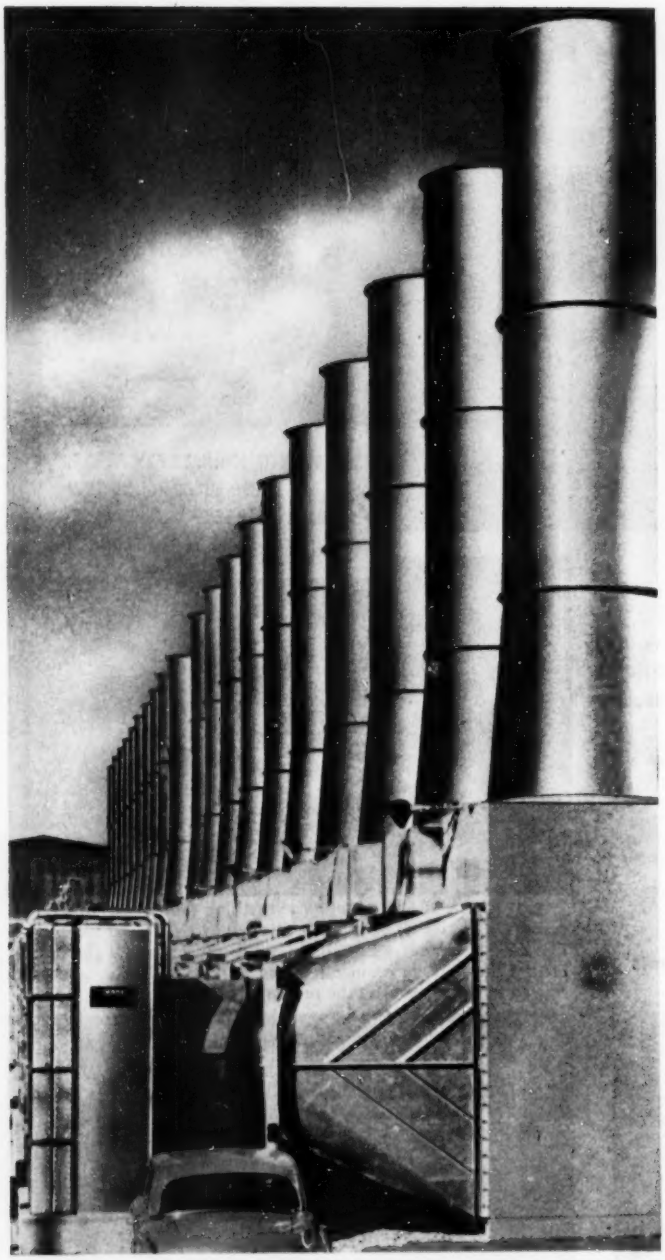
SAYS ALBERT HERDA . . . "Hauling everything from beer to eggs . . . across every kind of country . . . through every kind of weather . . . I've used Cities Service "C" Series oils and have had the best of luck. I heartily recommend Cities Service Oils for unusually rugged service as well as the ordinary job."

HIS OWN SERVICEMAN ON LONG, LONELY HAULS . . . Besides driving, Herda handles all the jobs of truck maintenance on the road . . . everything from changing tires to checking the oil. During the summer when temperatures soar up over a hundred, "C" 300 Series SAE 30 gives him the long motor oil mileage and complete engine protection he must have.

BLOWTORCH HEATS CAB IN ALASKA COLD . . . Big bus heater not enough to heat cab in extreme cold. Blowtorch aimed at feet does job. Under such tough operating conditions, Herda depends on "C" 300 Series SAE 30 to give complete lubrication and engine protection. High quality Cities Service Products can serve best in your operation too.

FOR KAISER OR FOR YOU

TRANE builds a diesel cooler that's right!



Here is an installation of TRANE Dry-Type Fluid Coolers at the Kaiser Chalmette plant. If *you* have a diesel jacket water or lube oil cooling job, contact your nearest TRANE sales office for more information on TRANE Fluid Coolers.

Nearly 240,000,000 BTU Per Hour are removed by TRANE Dry-Type fluid coolers from lube oil and jacket water at the new Kaiser Chalmette, La. aluminum plant. There are eighty 1,820 hp gas engines—and a TRANE Fluid Cooler for each engine.

What are *your* diesel cooling needs? A fraction of the Kaiser requirements? Or greater? You can get the cooling you need from the complete TRANE line of fluid coolers. Consider these advantages:

5 Advantages Of TRANE Closed-System Air Cooling

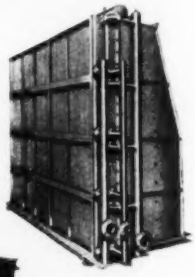
1. No Water Problems—There's no fouling, so there's no water treating problems, no expensive cooling tower maintenance. Air does the cooling!

2. Many Sizes—Choose from 22 standard sizes of TRANE Dry-Type Fluid Coolers. Special sizes if necessary.

3. Rugged Construction—Strong framework. Famous TRANE fin-and-tube extended surface coils.

4. Low Horsepower Requirements—The combination of plate type fins and carefully engineered fans and plenum chambers means power savings worth hundreds of dollars a year. Adjustable fan pitch and variable speed on many models.

5. Easy Maintenance—Removable header cover plates. Tubes easily cleaned. Motors accessible.



Series EC, horizontal TRANE Dry-Type Fluid Coolers. Fourteen sizes: fan diameter from 18″ to 120″.

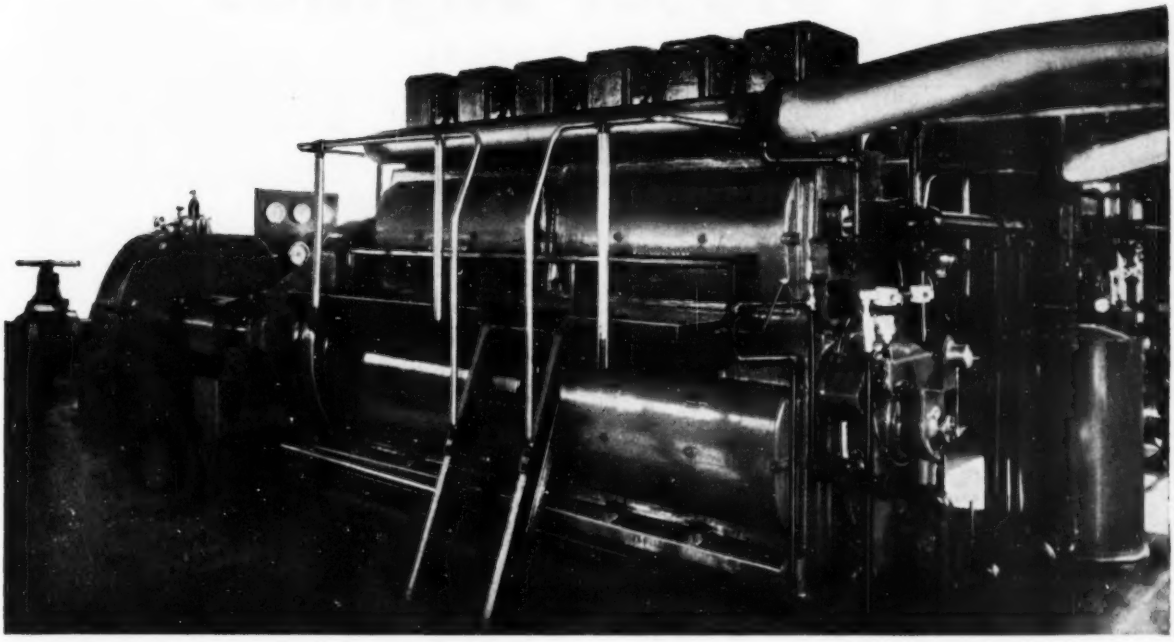
Series GC, giant vertical TRANE Fluid Coolers. Eight sizes: fan diameters from 72″ to 144″.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . . Toronto
Offices in 80 U. S. and 14 Canadian Cities

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

at the Anthony Station of Magnolia Pipe Line . . .



89.6% of elapsed time

for 11 years . . . that's Alco dependability

On-the-job performance—the toughest test of all shows what Alco Standardized Diesels can do. Two of these engines installed at the Anthony Station of the Magnolia Pipe Line have each rolled up over 90,000 hours of operation since installation. They have run as much as 94.9% of the elapsed time in a single year.

In addition to this kind of performance, pumping station superintendents also like Alco Standardized Diesels because of their economy:

- **Compactness** for lower construction costs
- **Higher engine efficiency** for lower fuel costs
- **Medium speed** for lower auxiliary equipment costs
- **Flexible power range** for lower expansion costs

In the last ten years *more Alco Diesel Engines have been installed in oil pipe line pumping service in the United States and Canada, than any others.* To find out how they can help you, contact your nearest American Locomotive Company Sales Office at Beaumont, Chicago, Cleveland, Houston, Kansas City, New York, San Francisco, Schenectady or St. Louis.

ALCO DIESELS

THE MARK OF MODERN ENGINEERING

AMERICAN LOCOMOTIVE COMPANY

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P&H Diesel Engines

(2-CYCLE)

Can you do this with your diesels?

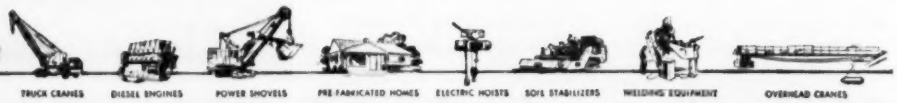
Within just 40 minutes you can remove a cylinder assembly — replace it with a complete new one — and have your P&H Diesel back in service.

No other diesel offers you such amazing speed and simplicity — such protection against costly lay-ups. Think what it can mean to you in time and cost savings — in simpler parts stocks. Where necessary, you can take an assembly from one engine to another . . . good reason in itself for standardizing on P&H Diesels.

This is only one of many advantages you'll find in this advanced line of P&H Diesels. Ask your nearest P&H Diesel representative for complete facts. Or write us.

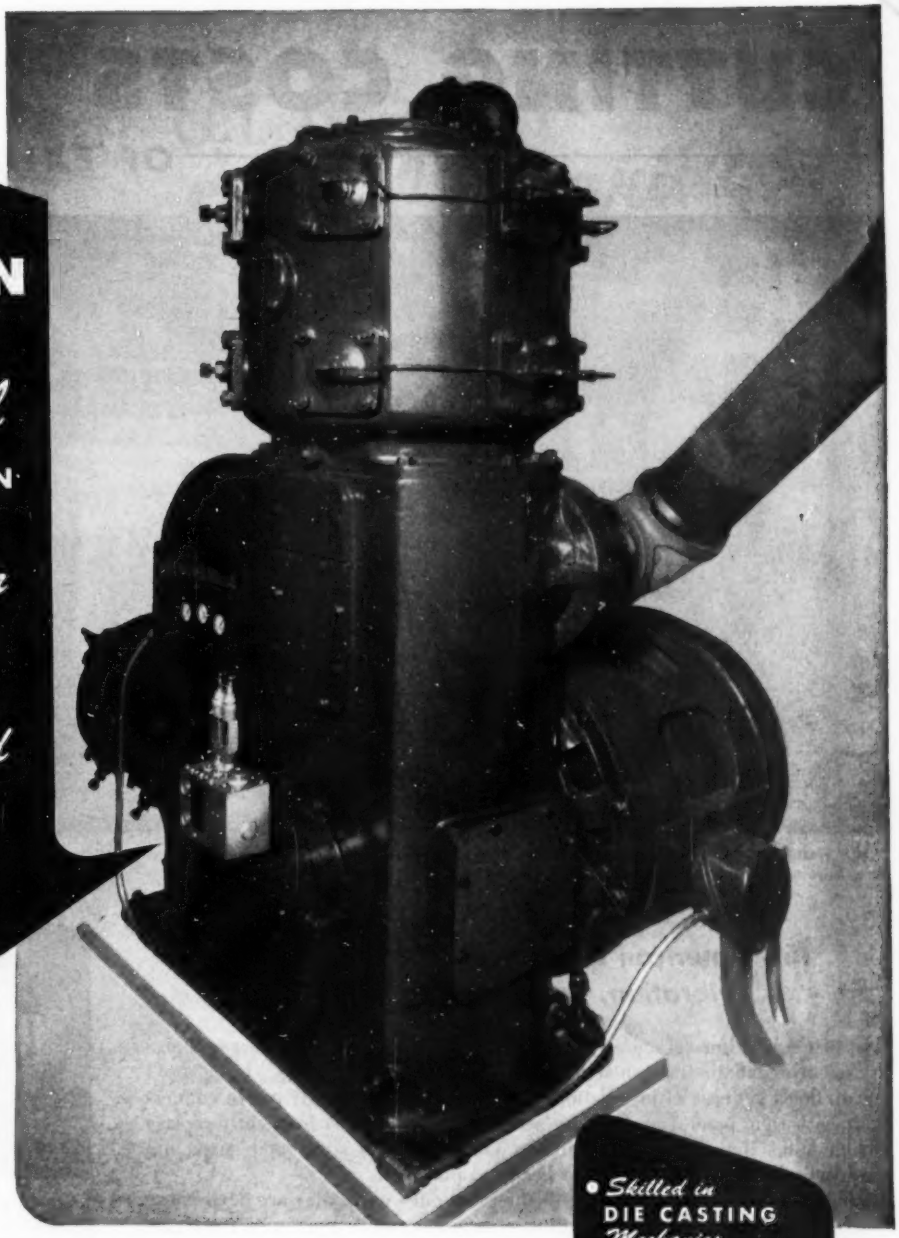
P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
CRYSTAL LAKE, ILLINOIS

the P&H *Line*



MADISON -KIPP *fresh oil* LUBRICATION

fed under pressure by the measured drop!



Illustrated, the Madison-Kipp Model SVH Lubricator on an Ingersoll-Rand XLE Compressor.

- *Skilled in* DIE CASTING *Mechanics*
- *Originators of Really High Speed* AIR TOOLS
- *Experienced in* LUBRICATION *Engineering*

....STANDARD EQUIPMENT ON COMPRESSORS, WORK ENGINES AND MACHINE TOOLS....

Oil under pressure fed drop by drop from a Madison-Kipp Lubricator will definitely increase the production potential for years to come when applied as original equipment on new machine tools, work engines and compressors. There are six popular models for every application. Write for special engineering data for your particular requirement.

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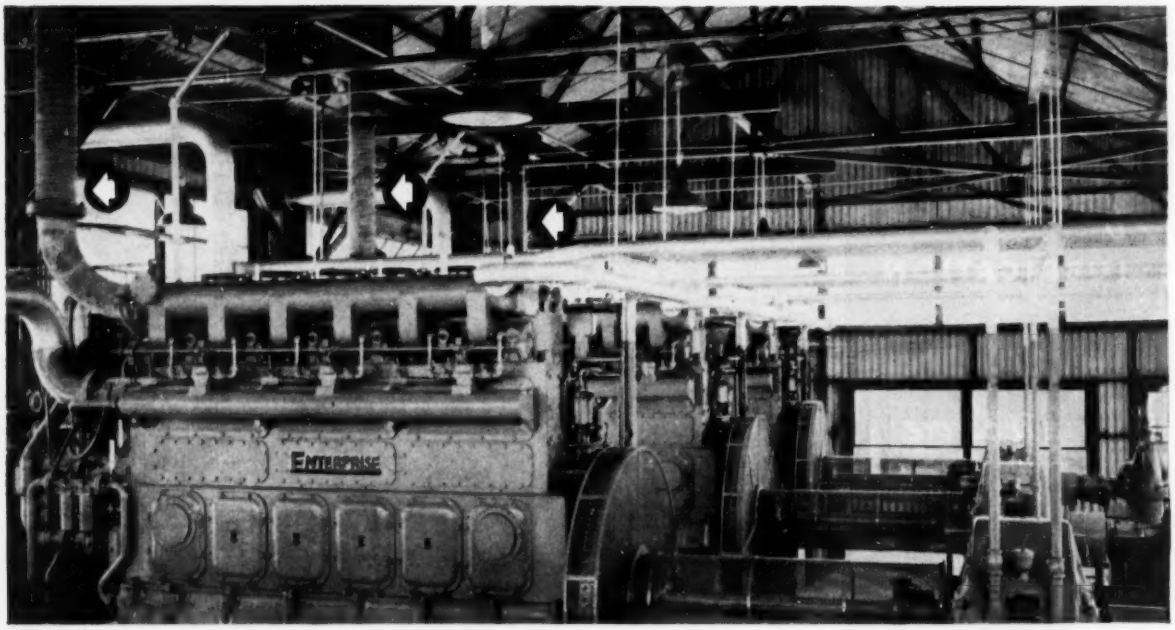
CUTTING COSTS

OF EXHAUST LINES



HARD WORKING Enterprise Dual Fuel (460 HP) Diesel Engines in Union Oil Marine Pumping Terminal, Avila, California, depend on American Corrugated Steel Hose to absorb stresses set up by vibration and heat.

This American Flexible Steel Hose absorbs vibration, prevents line breaks

Cost of exhaust lines is more than a matter of initial price. It is measured also in ease of installation and in service.

You don't get ease of installation when you must laboriously match connections with rigid pipe. You don't get service when you must frequently replace flexible lines that fatigue prematurely, fastenings that shear and snap, and rigid lines that crack from engine heat and pulsation.

The cost of exhaust lines is worth the price only when they are *flexible* and *tough enough* to take vibration, pulsation, and extreme temperature variations for long periods. Such basic toughness is built into American Flexible Steel Exhaust and Air Intake Hose. Throughout thousands of hours of rugged engine operation, it will give uninterrupted service.

In addition to exhaust and air intake lines, there's a whole family of ready-to-use American Flexible Metal Connectors to help solve potentially troublesome piping problems: starting air, circulating water, fuel oil, lubricating oil, etc.—both on marine and stationary diesel engines. It will pay you to ask us for complete literature.

For original equipment or for replacement, specify American Flexible Corrugated Steel Hose. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Limited.

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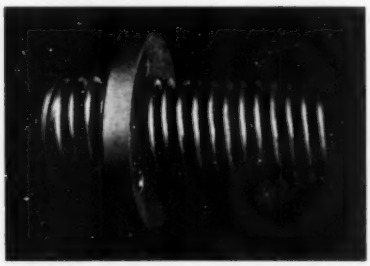

AMERICAN Corrugated Steel Exhaust Hose is available in sizes through 16" I.D. Flanges to ASA standards or Navy specifications can be supplied.

NEW, INFORMATIVE BOOKLET EH-50 ready soon. Write for copy. Includes data on dimensions, bending diameters, weights, pressures, etc.; also information on fittings, flanges.

wherever connectors must move . . .

American ANACONDA **FLEXIBLE METAL HOSE AND TUBING**

Don't let this happen to your Diesel bearings!

(Above) Photograph of surface of corroded copper-lead Diesel engine bearing. (Left) Photomicrograph of section through same bearing, showing loss of lead on the bearing surface after attack by corrosive elements. Note how the copper (white areas) is beginning to crumble. Lead is shown in gray.

Play safe with

GULF DIESELMOTIVE OIL

-it's noncorrosive to copper-lead and silver bearings

In millions of miles of service, Gulf Dieselmotive Oil has proved to be noncorrosive to both copper-lead and silver bearings. There are several good reasons for this kind of performance: first, Gulf Dieselmotive Oil is made from a high quality base stock; second, it's 100% solvent refined; and third, it contains the right combination and concentration of additives. As a result, this quality lubricant is not corrosive, even after long periods of service.

If you want to avoid troubles like that pictured above, switch to Gulf Dieselmotive Oil. For further information, write, wire, or phone your nearest Gulf office.

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GULF REFINING COMPANY
PITTSBURGH 30, PA.

GULF

Even a thimbleful of fuel oil

burned in a General Motors Diesel locomotive, hauls one ton of freight one-half mile

A switch in time saves nine...

In yard-switching service, for example, a GM Diesel locomotive uses *nine-tenths less* fuel oil per hour than an oil-burning steam locomotive. If all work on railroads were done with Diesels, America would save 182,500,000 gallons of oil and 62,000,000 tons of coal a year.

TO CONSERVE FUEL AMERICA NEEDS MORE DIESELS!

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

LA GRANGE, ILLINOIS—*In Canada:* GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO

If you are interested in the conservation of fuel by Diesel locomotives, write Electro-Motive Division for a recent study.

THIS YOUNG TUBE-AND-FIN CORE PAYS A BONUS!
● PERMANENT, PERFECT BOND BETWEEN TUBES AND FINS
● GREATER HEAT TRANSFER EFFICIENCY
This die-formed collar provides a tight, permanent bond along entire length of tube as shown in cross section at left.

Here's why Young-designed and built tube and plate fin cores give greater heat transfer efficiency . . . stand up better under peak capacity operation . . . pay bigger dividends in longer trouble-free service. The outstanding design and construction of the Young plate type fin core, shown above, features specially die-formed reinforced collars which make a continuous, *permanent* bond between fins and tubes . . . providing maximum heat transfer and greatly stronger, longer-lasting cores.

This mechanical structure of greater strength which permits the use of the most desirable metals chosen for the job — copper, aluminum or other alloys — is attributable to Young's precision-manufactured, high-quality cores.

Whatever your need, consult your nearest Young Sales Representative to help you select correct cores — types and sizes — and discuss any phase of your heat transfer problems.

One of our many important installations is the Reynolds Metals Company's new San Patricio, Texas plant which uses more than 80 Young units featuring the new "bonus" core for cooling engine jacket water and lube oil, and 91 additional units of Young variated, specialty designed construction.

1927 • 1952

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Heating, Cooling, Air Conditioning Products for Home and Industry.

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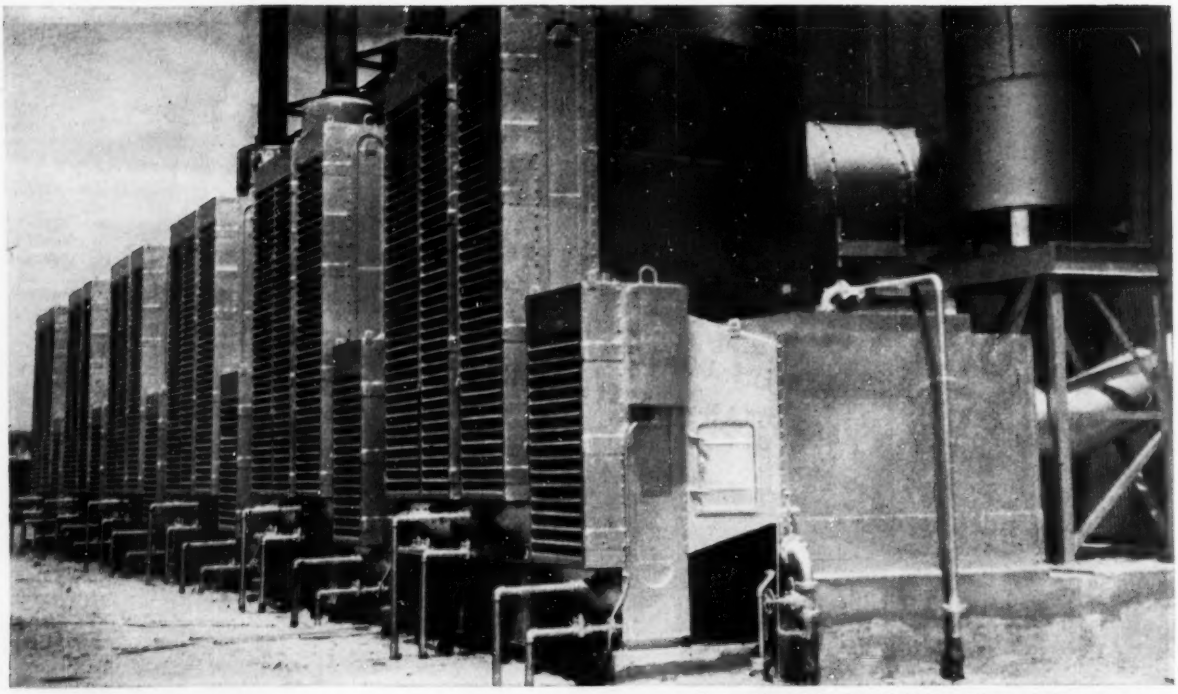
Factories at Racine, Wisconsin and Mattoon, Illinois



One section of the 130 Multi-Duty Filters which serve 83 engines and power house ventilation system.

Filtering 5,500,000 cfm!

130 AAF Multi-Duty Filters Serve Engine Room of New Reynolds San Patricio Plant

Imagine a power plant capable of supplying electricity for the combined residences of Ft. Worth, Dallas, Houston and San Antonio! That's the generating capacity of the 83 engines serving Reynolds Metals new aluminum reduction plant at San Patricio, Texas.

This "powerhouse" is made up of 42 Cooper-Bessemer, 3700 hp., 4-cycle, supercharged engines and 41 General Motors, 2850 hp., 2-cycle radial gas engines. Their air intake requirements plus that of the engine room ventilating system total 5,500,000 cfm.

Protecting this multimillion-dollar investment against the ravages of dust and dirt are 130 AAF Multi-Duty Type CMS Filters. These filters, designed for heavy dust loads, clean both the air and themselves *automatically*. It is this continuous, self-cleaning action that assures uniform air delivery and constant high air-cleaning efficiency. And in this installation the Viscosine filter oil is continuously circulated and cleaned to further simplify maintenance.

This installation solves Reynolds air-cleaning problems. Yours may be different. AAF has both engineering experience and a line of filters which, when combined, result in the solution—not just a sale. We'll welcome the opportunity to work with you in cutting costs with clean air.

Today's Best Buy is Better Air!

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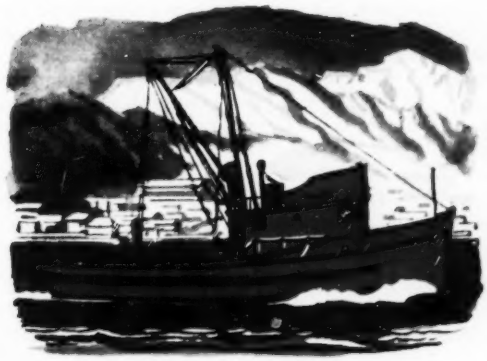
Men who depend on power...know they can depend on CUMMINS®

Every CUMMINS DIESEL is built not once but twice



Whatever the power application—whether it's in the marine field or mining, trucking or construction, drilling or handling dozens of other important tasks—you're sure of a consistently reliable performance with a Cummins Diesel on the job.

Every Cummins Diesel is actually built *twice!* After initial assembly and run-in testing, every engine is disassembled, inspected; then reassembled and tested again.

This extra care—together with Cummins' exclusive fuel system and efficient parts and service organization—makes lightweight, high-speed (50-550 h.p.) Cummins Diesels a wise first choice *for men who depend on power.* See your Cummins dealer.

CUMMINS ENGINE COMPANY, INC., Columbus, Ind.

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Leaders in lightweight, high-speed diesel power!

CUMMINS DIESEL

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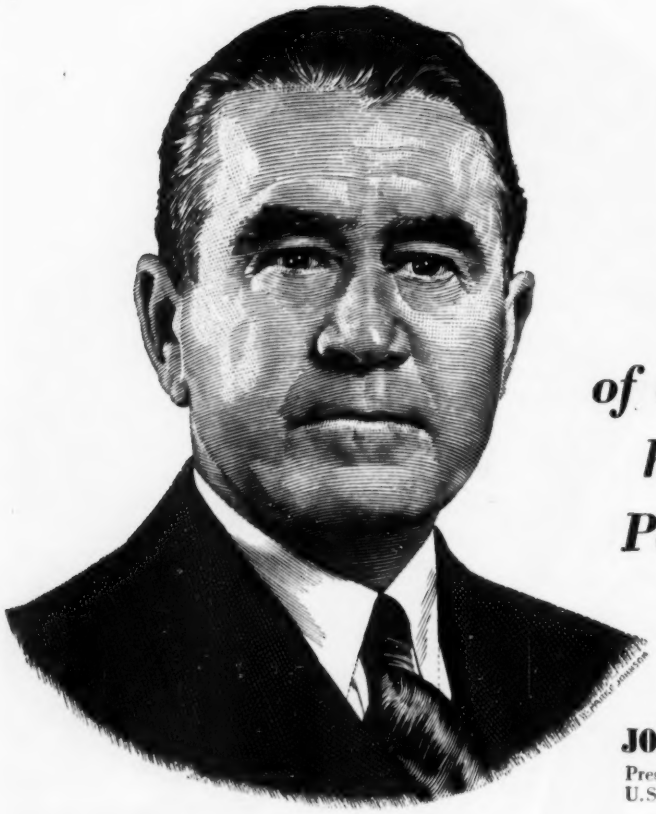

"More than 98% of our 27,000 employees have enrolled in the Payroll Savings Plan"

JOHN E. GOBLE
President, National Tube Division,
U.S. Steel Corporation

"We of the National Tube Division of the United States Steel, recognize that systematic saving through the Payroll Deduction Plan is an investment in the security of the Nation, as well as of the individual. We are proud of the participation resulting from a person-to-person canvass in our plants and offices. More than 98% of our 27,000 employees have enrolled in the Payroll Savings Plan—a complete affirmation of their faith in America. Such personal savings are the backbone of our free enterprise system."

Concisely, clearly, Mr. Goble cites three of the reasons why 98% of the 27,000 employees of National Tube are enrolled in the Payroll Savings Plan:

- recognition by management that the Payroll Savings Plan contributes "to the security of the Nation as well as of the individual."
- the purchase of Defense Bonds through payroll deductions is concrete affirmation of Americans' faith in America.
- a person-to-person canvass in plants and offices put a Payroll Savings application in the hands of every National Tube employee.

There is still another reason for National Tube's outstanding employee participation: *Mr. Goble's personal interest in the Payroll Savings Plan, and the conducting of the person-to-person canvass.*

State Directors of the Treasury Department, members of the Field Staff of the Payroll Savings Division, Volunteer Chairmen of industry groups—everyone associated with the Payroll Savings Plan—will tell you that every highly successful Payroll Plan is a reflection of the deep interest and personal effort of the company's top executive.

If you are the man who makes the top decisions in your company, ask today for a report of *your* Payroll Savings Plan, particularly, the percentage of participation. Then, call a meeting of your associates. Show them this statement of Mr. Goble's. Tell them you are going "all out" to put your company (large or small) in the front rank of those who can be justly proud of their Payroll Savings Plan.

A phone call, wire or letter to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D.C., will bring prompt cooperation from your State Director.

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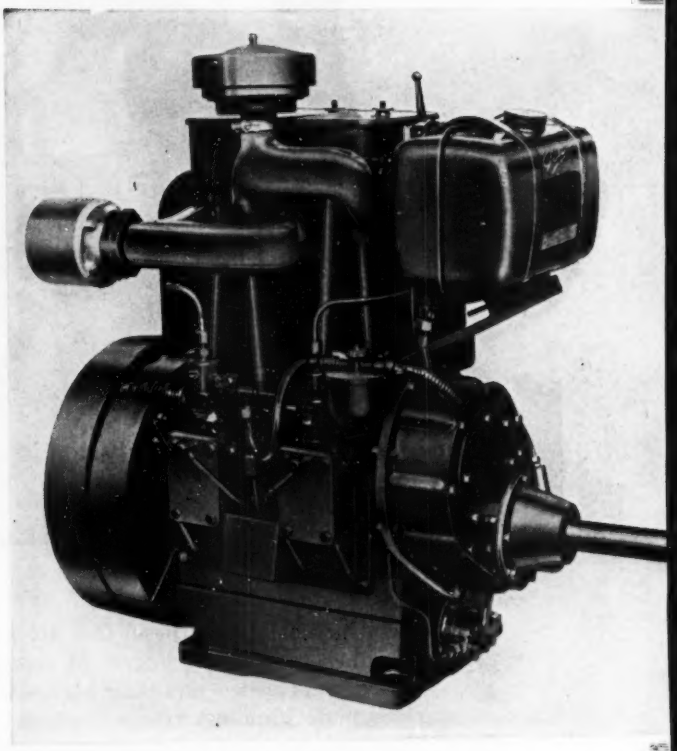

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Reliability, Low Maintenance Costs
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300,000 Petter Diesels now in use
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ENGINE DIVISION OF BRUSH ABOE INC.

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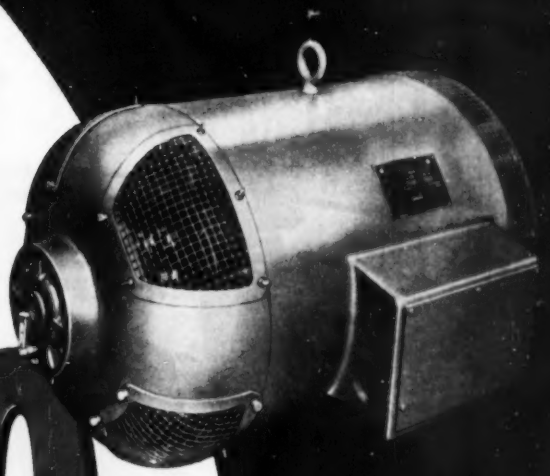
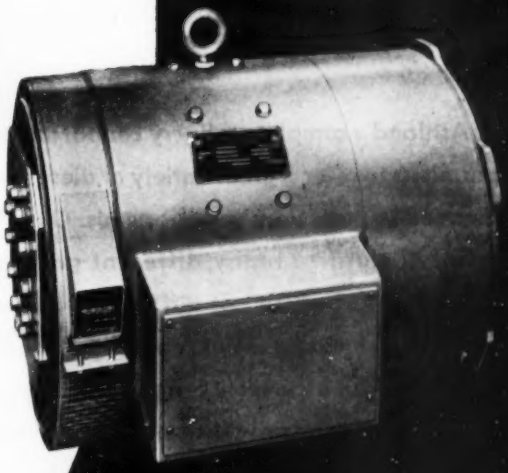
Power for every purpose—

DELCO GENERATORS



AC GENERATORS
20 KW through 150 KW at 1200 RPM
20 KW through 200 KW at 1800 RPM



DC GENERATORS
20 KW through 90 KW at 1800 RPM
20 KW through 75 KW at 1500 RPM
20 KW through 60 KW at 1200 RPM

With a power range of 20 KW through 200 KW, AC and DC, 1200, 1500 and 1800 RPM, Delco generators are ideal for use with Diesel power plants.

Hospitals, public buildings, factories, construction jobs, circuses, carnivals and many other businesses often require such independently powered utilities, of a stand-by or portable nature. When the generator is a Delco the delivered power is not only adequate but unfailing. Any of the sales offices listed below will be glad to supply detailed information.

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DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

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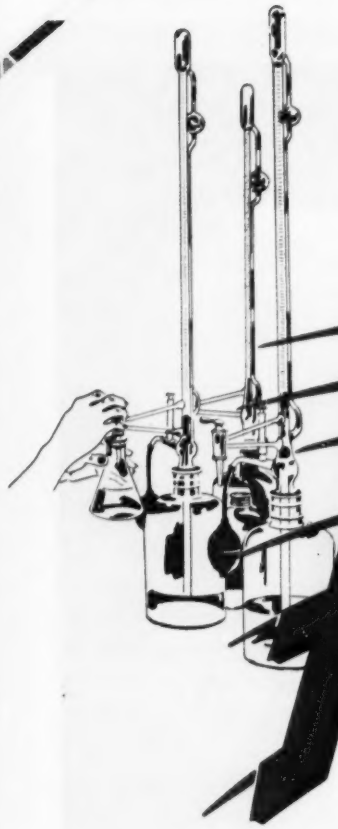

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to your specifications

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fuels and lubricants

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Ashland and Valvoline offer a complete line of quality lubricants, each made for the specific job. Available lubricants include those made from pure Pennsylvania crude, also conventionally and solvent refined mid-continent stocks.

Get in touch with us and we will be glad to have our nearest representative provide you with test samples of our fuels and lubricants from which you can choose exactly what you want.

. . . complete line of lubricants for diesel equipment

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✓ **LOW OPERATING COST**

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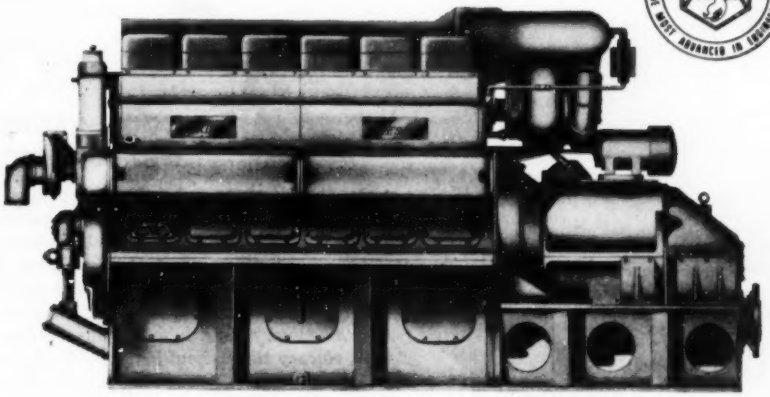
For fifty years the Sterling Engine Company has been producing high quality light and heavy duty equipment for an ever widening variety of industrial applications.

No matter how diverse the applications, however, Sterling engines have always been characterized by the "Big Three" value that has spelled efficiency and economy to engineers and industrial users for generations.



Sterling Viking Diesel 6 cylinder marine engine with reverse gear rated at 665 HP in continuous service.

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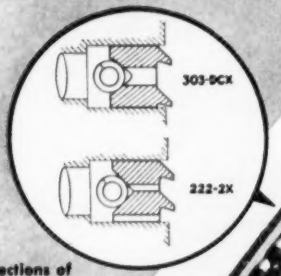
Why COOK "SUPER-FLEX" OIL CONTROL RINGS *reduce lube-oil consumption*



Sections of two typical rings.

Coil peripheral compression type expander, contained by the ring, simplifies application—fits existing grooves.

Straight-line oil flow, unrestricted by expander, assures maximum drainage.

Flexible ring section assures cylinder contact at all points—provides uniform and positive wiping action.

Tension is adjustable by inserting washers here.

Spring wire of rectangular cross-section gives expander stability—reduces localized stresses—assures uniform tension.

Ring and Expander Spring "float" in groove—cylinder contact is undisturbed by piston "slap".

Expander never touches groove lands or bottom—preventing damage to groove and expander.

COOK "SUPER-FLEX" OIL CONTROL RINGS

meet the crying demand for a more flexible ring that will conform to cylinder distortion and at the same time provide uniform wiping action all the way around the cylinder. Available in many styles to meet varying piston conditions, these advanced design oil rings reduce lube-oil consumption and maintain their efficacy throughout ring life. Write for recommendations job-engineered to your particular engine requirements. C. Lee Cook Mfg. Co., Incorporated, Louisville 3, Ky. Representatives in principal industrial cities.

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PISTON RINGS

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AND DIESEL TRANSPORTATION

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August, 1952

Vol. 20, No. 8

Cover Photo: A Caterpillar D-7 with an 8 cu yd scraper putting the finishing touches on a ramp leading to a new pile bent bridge in Korea.

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A comprehensive article dealing with the selection of lube oils for automotive-type engines.

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WATCHING FOR WIGGLES

INSURES SMOOTH PERFORMANCE OF ENTERPRISE STATIONARY DIESELS

Thorough testing by means of the oscillograph and other scientific instruments, means long engine life—free from vibration troubles.

Vibration at critical speeds can lead to broken shafts, damaged gears and costly engine failure. To check these forces and insure smoothest engine operation, ENTERPRISE DIESELS are *performance-tested* by highly sensitive electronic instruments.

For the finest in dependable stationary power, specify quality-built ENTERPRISE DIESELS—the choice of power experts. Models from 68 to 2056 HP, generator sets to 1402 KW. 3, 4, 6 and 8 cylinders, normally aspirated and turbocharged.

Write for free copy of "Taking The Mystery out of Torsional Vibration," Bulletin ES-B7.

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Enterprise
DEPENDABLE
Diesels

Editorially Speaking . . . .

Criteria Revision Needed

Supersonic speeds; incredible altitudes; jet and rocket engines with thrusts that are outstripping the capabilities of airframes — that's the Air Force.

Outmoded engine speeds; hampering type criteria; arbitrary restrictions — that's the Air Force, too, when specifying procurement criteria for diesel-electric generators.

A recent directive states, ". . . procurement of diesel-electric generators under the public works program for the Air Force for installation as the primary source of electrical power at Air Force bases be controlled by the following criteria . . ."

Note the "primary source" reference. They run piston engines at over 2600 rpm and what can be a more "primary source" of power than an aircraft engine. But what is specified for diesel generator sets? "a. Maximum speeds will not exceed . . .

Units rated 100 kw and below . . . .720 rpm
100 kw to 300 kw . . . .600 rpm
300 kw to 1000 kw . . .450 rpm
1000 kw and above . . .360 rpm"

This sent us scurrying to our April Specification Issue. Of 48 firms listed, nine catered exclusively to marine or converted purchased engines for special purposes. This narrows the field to 39 firms.

Up to 100 kw, 720 rpm, only six firms qualified on the basis of stated ratings. One builds for his own use and two build taboo horizontal engines, leaving three. Four firms could be added by derating engines up to 12 per cent. None are "big" producers of engines.

In the next category, 12 firms could supply suitable engines by using the lowest ratings of their hp/rpm ranges. Only about five have any great production capacity.

The figures and comment are about the same for the next bracket.

The 360 rpm for the "1000 kw and up" category is more reasonable, particularly for the "up" variety. There are 11 suppliers with six having good capacity. Here, we worked to the lower end of the range to get the maximum number of suppliers. In other categories we worked to the top limit on the basis of the larger the engine, the lower the rpm.

Armed Forces procurement policy is to seek competition and the broadest base of supply. Speed limitations alone (excepting the last category) have largely defeated th objective. Additional criteria further narrows the field.

Cylinders must be vertical and in-line. One crankshaft must be used. Speed restrictions eliminate mass producers such as Buda, Cummins, Caterpillar, Hercules, International-Harvester, etc. Cleveland Diesel, EMD, Cummins, Caterpillar, Cooper-Bessemer are out so far as their vee-type engines are concerned. Fairbanks-Morse's OP engine is unacceptable.

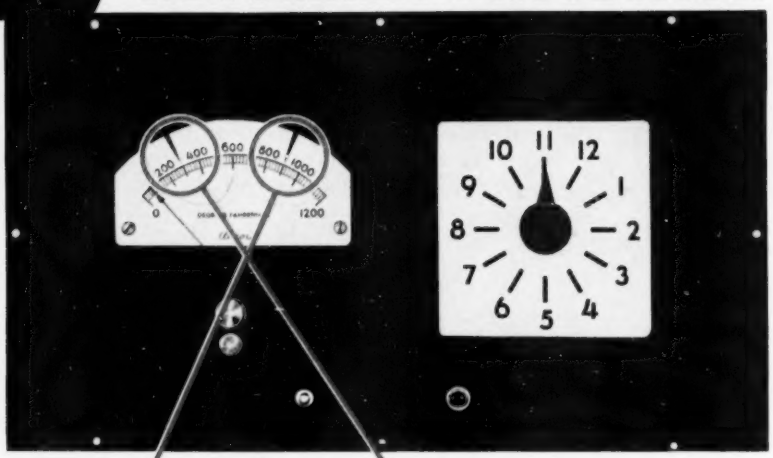
Supercharged engines are acceptable—*if* —maximum cylinder pressures do not exceed those of non-supercharged executions by more than 5 per cent!

The criteria is too restrictive. It deprives the Air Force of the benefits of progress and limits their source of supply. If they want heavy duty engines—O.K. But just what is "heavy duty" in terms of today's advanced technology?

Someone sold the Air Force a bill of goods. Engines with characteristics and ratings more in line with current commercial practices are doing a good job all over the world—for all the other Armed Services and the State Department. This directive requires review.

Alnor

PYROTAC AUTOMATIC PROTECTION



AGAINST *high* AND *low* EXHAUST TEMPERATURES

The surest way to check engine performance is through constant monitoring of exhaust temperatures. Alnor—pioneer in Diesel Pyrometry—now brings you the latest development in the field of Diesel instrumentation. It is the Type 4490 Pyrotac that provides automatic protection against damage due to *both* high and low exhaust temperatures.

The Pyrotac automatically reads every cylinder temperature in the engine every few seconds. When one temperature varies from the rest, the Pyrotac tells you which cylinder—and how much.

If temperatures continue to rise—or fall below pre-set standards, the Pyrotac will automatically sound an alarm, or shut down the engine—and the switch pointer will stop at position of offending cylinder.

Man knows only that which he can measure

Small or large, your Diesel demands the protection of an Alnor Exhaust Pyrometer . . . a proved way to lower cost performance uninterrupted by "foreseeable" breakdowns. Write today for Pyrotac Bulletin 4361 and see how an Alnor engineered and equipped pyrometer installation will fill your needs.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

ILLINOIS TESTING LABORATORIES, INC.

ROOM 507, 420 NO. LASALLE ST., CHICAGO 10, ILLINOIS

PYROMETERS • VELOMETERS • DEW POINTERS • PYROCONS • PYRO LANCES • THERMO-ANEMOMETERS • CONTROLLERS

+ HIGHLIGHTS +

● Noise reduction of a diesel engine can be effected by modification of cylinder head covers, as much as 8 db, with an aluminum container packed with 3 in of glass fiber, it was found in experiments at the Naval Engineering Experiment Station, Annapolis.

● Highway experts from 28 nations and territories are observing road construction and maintenance in the United States.

● New locomotives put in service in 1951 totaled 2558, of which 2537 were diesel, 18 steam and 3 electric.

● According to Steelways, ten years ago, depending on the type of plant, it cost $10,000 to $15,000 to create a job in the steel industry. Today, it costs over $90,000 per job.

● In India, Wales, and South America, are located the narrowest gauge common carrier railroads in the world. The distance between rails on these railroads is 1 ft., 11½ in.

● Production of engineering alloy steels, used for component parts of machinery and equipment, was some 20 per cent greater in the United States last year.

● A total of 1182 new locomotives were on order for class I railroads as of July 1, 1952. All of these locomotives will be diesels, with the exception of 26 which will be steam.

● Manufacturers of replacement parts for automobiles and trucks have reported that their 1952 business should show a 7 to 10 per cent gain over 1951. Diesel should show even more.

● The Natural Gas Storage Company of Illinois stated to the FPC in a recent hearing, that natural gas deliveries from a proposed underground storage area in Illinois will some day equal the amount of gas that could be supplied to Chicago by three 30-in pipe lines.

● A $4,000,000 order for the construction of 40 lightweight steel passenger cars was recently placed by the Canadian Pacific Railroad.

● Government films have been made available for industry in many fields. There are three pertaining to diesel: "The Diesel Engine," "The Construction of Diesel Engines," and "Diesel Engine Fuel Systems."

● The total of all federal expenditures, for fiscal 1952, was $67 billion. That is more than $385 for every person in the United States. This is the highest amount for any year without total war.

● Progress in development of the world's finest international standard threads for screws is reported by the International Organization for Standardization.

● With diesels becoming more powerful and handling longer trains, more cars are needed. Car builders now have on hand sufficient orders for freight cars to keep them busy for about 16 months.

● According to the American Road Builders Association, federal aid to highways amounting to $1,385,000,000 for the fiscal years of 1954-55 will hit an all-time high, in a recent bill signed by President Truman.

● Corrosion causes an estimated annual loss of over six billion dollars in industry and elsewhere.

● Daily refining capacity for petroleum has been expanded by 120,000 barrels since the beginning of the year.

● The Arkansas Louisiana Gas Company has recently applied for authority to build a 75,000-hp compressor station in Arkansas.

● Primary aluminum figures indicate that the record pace set by the aluminum producers since January of this year is being maintained.

● The results of extensive development work on new equipment for power plants will come into view at the 20th National Exposition of Power and Mechanical Engineering in Grand Central Palace, New York, December 1 to 6, this year.

● A new 1952 monthly high in primary aluminum production was reached in May, according to the Aluminum Association. The 161,607,096 lb of primary aluminum, tops May of 1951 by more than 26 million lb.

● The U. S. Army Transportation Corp. is currently constructing a modern, well-equipped shop at Ft. Eustis, Virginia for the maintenance and repair of Army locomotives.

● In the first six months of 1952, class I railroads installed in service 1373 new locomotives, all of which were diesels except for 8 steam and one electric.

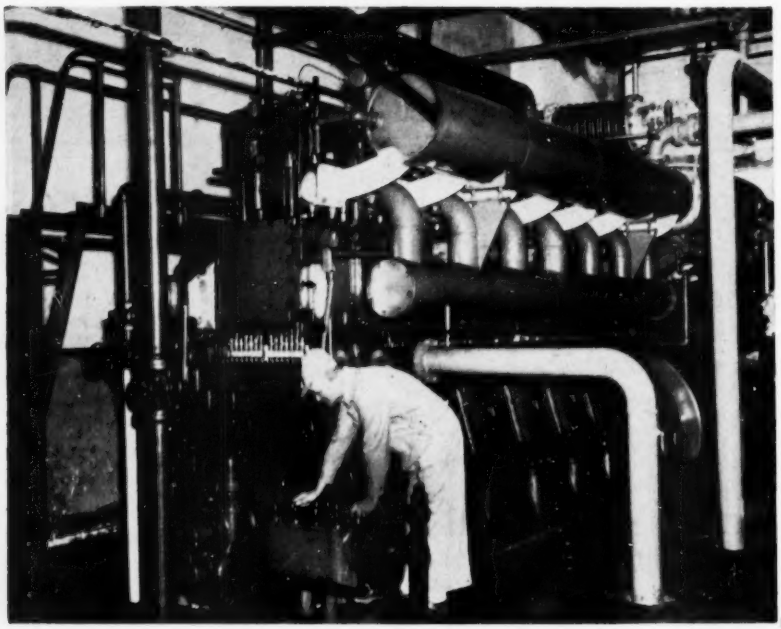
● The FPC reports that the operating revenues of natural gas companies reporting to the commission totaled $161,796,865, in April 1952. An increase of 13.2 per cent over April 1951.

● Diesels are handling 60 per cent of total passenger locomotive mileage even though 23,000 steam locomotives still remain in service.

● Fuel oil stocks on hand June 1st were sufficient to last 107 days as compared with 73 days a year ago.

● In the first six months of 1952, the production capacity of steel has been increased by 3.4 million ingot tons.

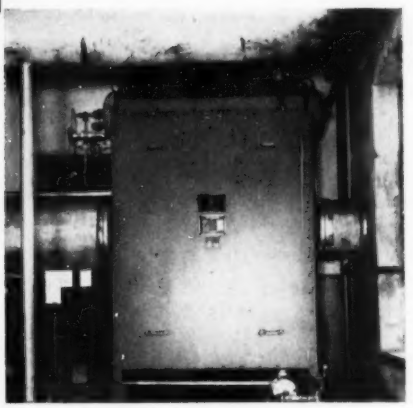
● At a recent meeting of the Public Service Commission in Albany, N. Y., a 31-point proposed safety code for gas installations and transmission was presented as an investigation was opened on gas safety. The code was submitted by pipe installation companies.



This 1440 hp Worthington dual fuel engine is now the principal prime mover at the David City, Nebraska plant.

A waste heat boiler provides 5 to 10 lb of steam to keep boiler feed water hot. This reduces the time needed to start the turbines.

The dual fuel engine (rear) and existing steam equipment were carefully integrated for better plant efficiency.



Dual-Fuel Engine

Takes Over From Turbines

Today, a 1440-hp dual-fuel engine has taken over virtually all of the plant load where previously steam turbines were the principal prime movers. Result—Plant operation is in the black.

A single Worthington dual-fuel engine is in virtually continuous operation in the David City, Nebraska, municipal power plant. It is currently supplying more than 96 per cent of the city's total electricity requirements. Taking over the load from a steam turbine, the engine cut fuel costs more than $14,400 in its first full year of operation. A cost reduction of better than 50 per cent.

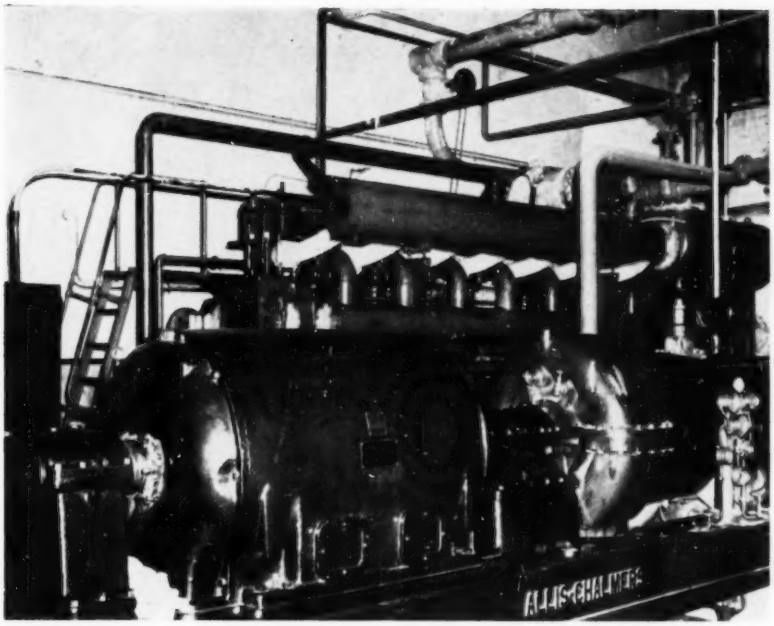
David City is a community of 2,300 population, county seat of agricultural Butler County. The city has been producing electric power since 1916 when it took over a privately-owned 80-kw steam plant. After a brief experiment with oil engines, the city reverted to steam with the installation in 1922 of a 250-kw steam engine. Then, in 1929, a 625-kw steam turbine and a 250-hp boiler were acquired. A second boiler of the same rating went in ten years later.

Licking Rising Costs

In recent years, David City has been faced with the problem of rising costs of fuel, labor and other elements of operating expense. In 1948, some economies were effected by equipping one boiler to burn natural gas instead of coal. Still the growing expenditures threatened to outstrip income.

It was decided that new, modern, economical generating facilities were the best means of combatting the inflationary trend and so, in August, 1949, the city put into operation a Model SEHGO-7, 4-cycle Supercharged Worthington dual-fuel engine. This 7-cyl. unit of 16-in. bore and 20-in. stroke is rated at 1440 hp at 360 rpm at David City's altitude.

The year ending April 30, 1947, with steam turbine and coal-burning boilers, fuel costs per kwhr reached a peak of 11.79 mills. In 1949, with one boiler burning natural gas, costs were cut to 9.58 mills. For 1950, the dual-fuel engine served part of the



through a waste heat boiler. This provides 5 to 10 lb. of steam which is used to keep boiler feed water hot and cut the time required to start the turbine.

The cooling system is partially integrated whereby the engine has a separate closed cooling water circuit but the raw water system serves both diesel and steam units. A centrifugal pump driven by a 10-hp motor circulates soft water through the engine jackets and a heat exchanger. A second identical pump serves as a standby. There are three motor-driven centrifugals to pump raw water through the exchanger and an induced draft cooling tower. One pump is adequate to handle the dual-fuel unit but all three are employed when the turbine operates. Jacket water makeup is treated in a zeolite-type softener.

year, cutting the fuel bill to 6.61 mills per kwhr.

Finally, in the fiscal year 1951, the engine operated the full year and slashed fuel costs for the plant to 4.75 mills per kwhr. Compared with 1949, the last full year before installation of the new engine, this meant a saving of 4.83 mills per kwhr. At this rate, fuel costs for 1951 were cut $14,433.49.

To accomplish this saving, the dual-fuel engine ran 7184 hours and generated 2,442,800 kwhr. In the same period, the turbine ran 1576 hours and produced 545,500 kwhr. Even this heavy dependence on the new engine was exceeded the next year. In the first six months of the 1951-52 fiscal year, the dual-fuel unit carried the load for 4267 hours, actually 96.6 per cent of the elapsed time.

In that six-month period, the engine produced 1,490,300 kwhr, which was 96.2 per cent of total plant production. The steam turbine ran just 149 hours, producing 58,700 kwhr. For the half year, the dual-fuel engine consumed natural gas costing $4530.89 and fuel oil costing $1407.68. Here is the picture of fuel costs per kwhr.

Natural gas	3.04 mills per kwhr
Fuel oil	0.94 mills per kwhr
Total fuel cost	3.98 mills per kwhr

Total plant average was down to 4.17 mills per kwhr.

Carries Entire Load

According to Light and Water Commissioner L. J. Reinhardt, the dual-fuel engine runs continuously and carries the entire load except when shut down briefly for normal preventive maintenance. It is the practice to run the steam turbine once every three weeks while the operators inspect the Worthington engine.

Continuous operation means that the dual-fuel unit must carry a varying load. Chief Engineer J. H. Shafer reports that load runs from a 200 kw valley to a 700 kw peak. A glance at the figures on engine hours and kwhr generation shows that the 1440-hp unit was called on for an average hourly production of just 349 kwhr. Obviously this light load does not permit maximum engine efficiency and makes even more impressive the fuel economies achieved.

Integration for Efficiency

In plant design, the dual-fuel engine was carefully integrated with the existing steam equipment. For example, engine exhaust gases which drive the engine's turbocharger then pass

Fuel Efficiency

Natural gas at 12 psi is the principal fuel used in this type engine. A small constant charge of fuel oil is injected to ignite the gas. For 100 per cent oil operation, there is an individual pump for each cylinder.

If gas pressure fails, the engine switches instantly to full oil operation and the governor, which had been regulating gas consumption, controls the quantity of oil injected. Mr. Shafer reports that the engine uses 45 gal. of pilot oil in 24 hours of dual-fuel operation. As a full diesel, the unit produces between 13 and 14 kwhr per gal. of fuel oil consumed.

One of the problems of early dual-fuel operation was a high consumption rate during part load operation. While diesels have never suffered as the result of excessive air at part loads, this has become a problem in dual-fuel and gas engines. With an unrestricted manifold as the load drops off excessive amounts of air are allowed to enter, the fuel-air mixture becomes too lean for good ignition. More gas is needed to improve the fuel-air ratio and the fuel consumption curve skyrockets.

In these engines, to insure proper fuel-air ratio, the amount of filtered air to the manifold is controlled auto-

Operating end and side of the dual fuel engine. The control cubicle is at right facing the engine.

matically to match the varying load as indicated by the exhaust temperature. To accomplish this action, a "Thermal Air Control" is used. This type of control actuates a butterfly throttling valve in the air discharge of the turbocharger, which in turn controls the capacity of the turbocharger. Best fuel economy results as the engine is supplied with the proper amount of air for good combustion at all times.

Finances Improve

In the years just prior to installation of the dual-fuel engine, David City's electric utility was in precarious financial condition. In a report submitted in 1951 by Black & Veatch, the consulting engineers said: "If it had not been for this improvement (installation of the dual-fuel engine), the department would not have been able to have absorbed its increased fixed charges to date without added revenues which could have been secured only by an increase in rates to the customers."

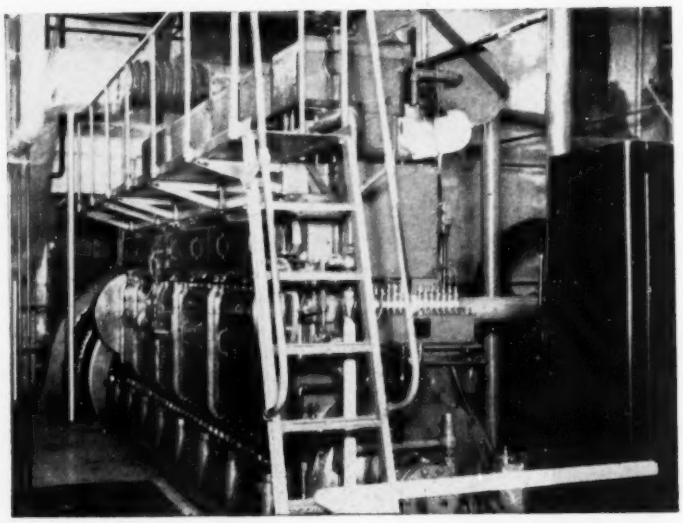
In the year ended April 30, 1951, the department was clearly in sound condition.

Electrical Earnings		$87,431.89
Production Costs	$34,735.10	
Distribution Costs	10,541.63	
Commercial Costs	1,853.13	
General and Misc.	2,599.99	
City Hall Building	1,138.53	
Total Operating Costs	$50,868.38	
Depreciation	16,734.42	67,602.80
Net Operating Profit		$19,829.09

As the load and production increase, reducing the unit cost of overhead and improving operating efficiency, David City can look forward to continuing and growing profits.

Plant operations are directed by Commissioner Reinhardt under the supervision of Mayor Earl Tilma and the Light and Water Committee of the Council, Richard Zeilinger, chairman, Roy Welte and Kenneth Nixon.

A shell and tube type heat exchanger is used to maintain engine jacket water temperatures.

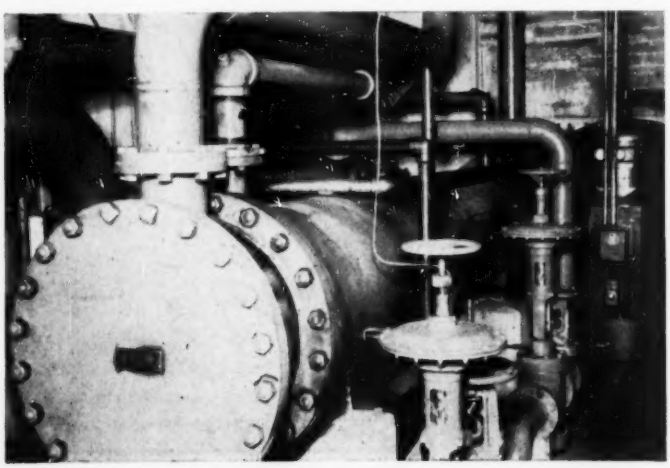


The effect of the new engine can be seen clearly in the statistics on five fiscal years.

Yr. End Apr. 30	Kwhr Gen.	Cost Fuel, $	Cost Fuel Per Kwhr
1947	2,291,590	$27,023	$0.01179
1948	2,448,550	33,918	0.01383
1949	2,741,100	26,267	0.00958
1950	2,984,230	19,743	0.00661
1951	2,988,300	14,210	0.00475

Principal Equipment

Engine	Worthington Corp.
Turbocharger	Elliott-Buchi
Governor	Woodward Governor Co.
Injection pumps	American Bosch Corp.
Cylinder lubricators	Manzel Inc.
Generator	General Electric Co.
Lube Oil System	
Oil	Socony-Vacuum Oil Co.
Filter	U. S. Hoffman Machinery Corp.
Cooler	Sims Co., Inc.
Thermostatic valves	Fisher Governor Co.
Fuel System	
Gas meter	Pittsburg Equitable Meter Co.
Gas regulator	Reynolds Gas Regulator Co.
Fuel oil	Phillips Petroleum Co.
Fuel oil filter	Cuno Engineering Co.
Cooling System	
Water pumps	Worthington Corp.
Tower	J. F. Prichard & Co.
Softener	Permutit Co.
Intake air filter	American Air Filter Co.
Heat exchanger	Graham
Waste heat boiler	Foster Wheeler Corp.
Instrumentation	
Gauge board	B & L Specialties Co.
Temperature regulator	Taylor
Pyrometer	Illinois Testing Labs., Inc.
Gauges	Jas. P. Marsh



Washington Slant

"RESOURCES FOR FREEDOM" REPORT by President's Materials Policy Commission cites that with only 10 per cent of the free-world population and 8 per cent of its area we consumed more than half of its 1950 supply of fundamental materials such as petroleum, iron ore, rubber, etc. They state that in spite of this, absolute shortages are not the real threat but that ". . . . insidiously rising costs which can undermine our rising standard of living, impair the dynamic quality of American capitalism and weaken the economic foundations of national security. . . ." is the thing most to be feared. Sounds like Republicans except that enervating taxes were left out.

MATERIALS-DEMAND PROJECTION TO 1975 shows that demand for minerals as a whole, including metals, fuels and non-metallics will increase about 90 per cent. Demands for energy in all forms will double (*seems low*). Electrical energy is seen increasing about 260 per cent to 1400 billion kwh. Atomic and solar energy for commercial use are predicted as lying in the future, beyond 1975. Demand for industrial water will increase 170 per cent. Most spectacular increases predicated on future trends of usage are: Fluorspar—threefold; bauxite for aluminum-fourfold; magnesium—eighteen to twentyfold.

FUEL SITUATION forseen calls for a doubling of demand for petroleum products; tripling of demand for natural gas; and about 60 per cent increase in demand for coal. Reemergence of coal as a fuel is seen, particularly with development of synthesis processes to convert coal to liquid and high-heat gaseous fuels at costs competitive with natural supplies. Liquid fuel extraction from oil-bearing shales is seen as adding to our reserves.

SYNTHETIC LIQUID FUELS PRODUCTION COSTS are not at all competitive at this time in spite of the above. Analysis of Ebasco Services, Inc. report for the Bureau of Mines indicates that as a commercial proposition, based on Jan. 1, 1951 data, gasoline cost would be 25 cents per gal. National Petroleum Council who made the analysis stated that on the basis of their research, costs would be as high as 41 cents. Much has been done since the report was prepared and improvements can be expected. It is something to watch but don't go overboard yet.

INDUSTRIAL CONSERVATION is the subject of a booklet put out by DPA. Described as "a guide to conservation engineering practices", it outlines broadly the objectives of the Conservation Division of the DPA. Ties in very neatly with "Resources" report. Organization of an in-plant conservation program is given and examples of savings quoted. Sounds like not only an important thing to do right now but also adds up to good management practices at any time. Our so-called "inexhaustable supply" of materials is diminishing or rising in cost to the point where we can no longer be wasteful. Conservation is good business.

AMENDMENTS TO M-ORDERS AND CMP REGS. are coming out thick and fast. They reflect the changing materials situation. In most cases they represent liberalization of controls or clarifications. Exceptions are for the continuing critical materials on which, unfortunately, the bulk of production must be based.

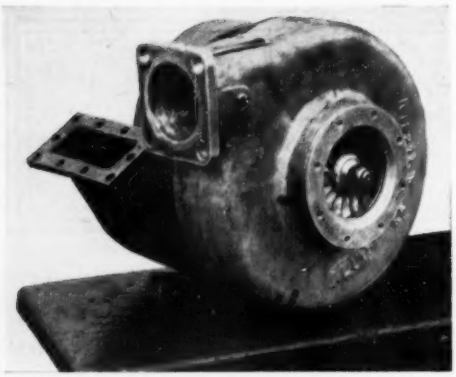
FOURTH QUARTER ALLOCATIONS FOR COPPER AND ALUMINUM have been announced with steel allocations waiting for the dust to settle. Copper quarterly supply estimates are 402,000 tons of the refined product including 160,000 tons from foreign sources. Potential 57,000-ton increase over Third Quarter supply is based on import increase due to recently announced price modifications. Minimum aluminum supply is set at 731 million lb. Allocation to Divisions of interest are shown.

Division	*Total Copper & Copper Alloys (000 lb)*	*Total Aluminum (000 lb)*
Engine & Turbine	29,178	3,091
General Components	184,274	22,601
Motor Vehicle	127,596	72,637
Railroad Equipment	86,300	5,135

Some copper allotments are down but generally balanced by increased aluminum allotments. For comparison with Third Quarter allotments see Diesel Power and Diesel Transportation May, 1952, page 39.

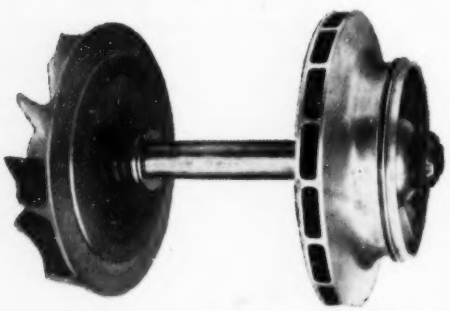
U. S. STEEL ORDERS are predicted to double for the next six months to build up inventories in defense plants and get things rolling again after the steel strike. Loss due to strike is computed at 20 million tons and military ratio will be upped to 30 per cent of production until 6 million tons are recovered—at the expense of the civilian economy. Losses are to be made up in the next three Quarters or sooner and J. D. Small, chairman of the Munitions Board, directed steps to be taken toward this end including "overtime and extra shift operation." Even after doubling the military "take" a larger-than-usual proportion is to be set aside to provide a reserve for the defense program. Export ban, laid June 10, was lifted for some shipments.

Turbochargers for Automotive Engines



ELLIOTT'S SPECIAL TURBOCHARGER designed for the Cummins Diesel Special is typical of the smaller sized units.

Turbocharging has lifted the specific power of engines. Turbochargers work; they have been proven dependable; they offer many corollary advantages. Why then, haven't they been used on automotive type diesel engines? The answer lies in the pecular service requirements and limitations of turbochargers—or it did until recently. Want to know more? Well, here is some data on what's being done.



ROTOR ASSEMBLY attains speeds in excess of 36,000 rpm and temperature differential between blower impeller, left, and turbine wheel, right, of more than 1000°F.

Opera singers have big chests: So do pearl divers. In every case where you need a lot of air, breathing capacity is increased. An engine breathes too. If you are going to burn more fuel to get more power, you need more air. It is impractical to expand the engine so you compress the air to get more into the cylinder.

Here is where the turbocharger comes in. Where it can be applied, you get the desired compressed air, and use waste energy in the exhaust system for power. Net horsepower gains are greater than would be the case with an engine-driven blower because no power must be subtracted to drive the turbocharger.

Application Problems

Now, consider engine applications. In most power applications, engines operate at relatively constant speed. In meeting power demands, the only other requirement is sufficient torque. Load changes are generally fairly slow and the torque curve, relatively flat in the normal operating range. Turbochargers vary their outputs automatically in response to variations in engine load and speed. In this case, we have, essentially, only one variable-load. The turbocharger suits its output to relatively slow load variations and things work out fine.

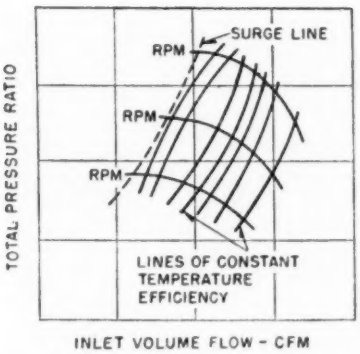
With automotive diesels, it is different. The operating range is considerably increased; in fact, with improper operation, it is hard to think of a condition that can't occur. You can get "low speed-high torque" and "high speed-low torque" conditions and all the intermediate combinations. Since the turbocharger is responsive to both engine load and speed, a design to meet all of the varying conditions satisfactorily has in the past seemed an almost insurmountable problem.

Then, there is acceleration. The acceleration rate is dependent on the excess engine power available at any given road speed, over and above that required to maintain the vehicle at that speed. The engine must be capable of increasing its power (rpm X torque) more rapidly than the load requirement increases with speed. And all of this jockeying around must be with smoke-free operation.

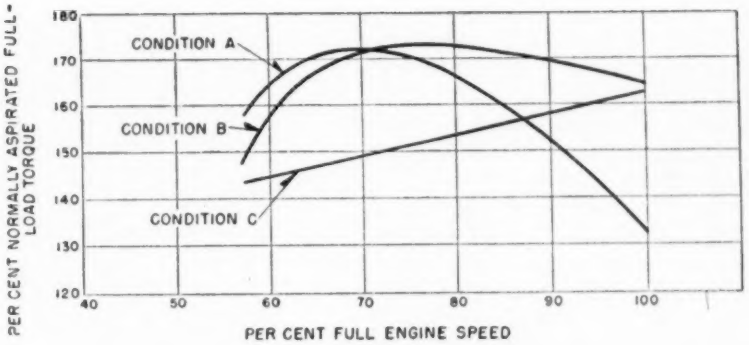
Small Turbocharger Development

The Elliott Company, with credit for better than seven million turbocharged horsepower in this country under their belt, has directed their experience toward this problem for the past several years. Two small sizes of turbochargers have been produced. A basic problem was whether the combined efficiency of a small turbocharger would be sufficient to allow the principles of turbocharging to be successfully carried out in a commercial design. Extensive development work and the cooperation of many diesel engine builders achieved the desired result. They have successfully turbocharged small high-speed engines from 25 to 50 per cent above their normally aspirated ratings.

However, merely increasing the power output and reducing the fuel consumption of a given engine was not sufficient to make the turbocharged high-speed diesel acceptable for use in automotive vehicles. This application required increased engine output torque with decreasing engine speed (rising torque curve) and excellent acceleration qualities combined with smoke-free operation under all conditions, as has been mentioned.



Performance curves indicating output characteristics of the special turbocharger.



Variation in engine torque curves obtainable by different combinations of turbocharger design and engine characteristics.

The characteristics of the turbocharged engine, at first, did not meet these requirements. Due to the absence of mechanical connection between the engine and blower, the enertia of the rotor caused a lag between the equalization of the engine air requirement and discharge delivery of the blower.

The problem of producing a satisfactory engine torque curve was attacked first. Analysis and experimentation was carried on to a point whereby proper combination of turbocharger design and engine characteristics, torque curves of various shapes could be obtained. Several of these are shown.

There yet remained the very important problem of obtaining good acceleration qualities from a turbocharged engine. An engine operating at low speed and load has very little energy in the exhaust gases. Consequently, the power developed by the turbine is small and the rotor speed of the turbocharger is maintained at a low value.

When load is suddenly applied, an increased quantity of fuel is injected into the engine cylinders before a sufficient amount of air is present for complete combustion. The rate of rise of energy level in the exhaust gases determines the rate of acceleration of the turbocharger rotor.

The time interval between application of load and stabilization of the rotor speed must be minimized to produce smoke-free combustion and satisfactory acceleration of the engine under load. This time interval could be reduced only by reducing the rotor inertia and increasing the efficiency of energy conversion in the turbine and blower.

The solution of the acceleration problem, therefore, was inherent in the basic design of the turbocharger rotor and also, to some extent, in the manner in which the turbocharger was combined with the engine.

Indianapolis a Testing Ground

When the Cummins Engine Company decided to produce a turbocharged diesel engine race car, the opportunity was presented to design for ultimate acceleration qualities in an automotive vehicle. It was recognized that if the extreme flexibility requirements of a race car could be met by a turbocharged engine, the lesser requirements of commercial vehicles could be achieved.

Design requirements were minimum rotor inertia combined with maximum performance from both the turbine and blower, satisfactory automotive torque characteristics, and materials to withstand high engine exhaust temperature. Overall size and weight of the unit also had to be at a minimum.

To cover the usable speed range of the engine in the race car, meant a very broad efficiency range from both the turbine and blower. Also, high-pressure ratio requirements meant very high rotative tip speeds and correspondingly high stress. All these requirements were combined into the special Elliott turbocharger designed specifically for the Cummins diesel race car.

The blower air flow and turbine exhaust gas flow had to be contained in casings within a few inches of each other, designed to withstand temperature differences in excess of 1000° F with no thermal distortion or excessive heat flow between adjacent areas. The turbine used was of the radial in-flow type. Pressure-lubricated sleeve bearings permitted operation in excess of 36,000 rpm. Characteristic performance of the small centrifugal blower is shown in the accompanying curves.

The record-breaking runs of the Cummins diesel race car have proved that good flexibility, acceleration, and satisfactory performance can and have been produced using a turbocharged engine.

What's the Outcome

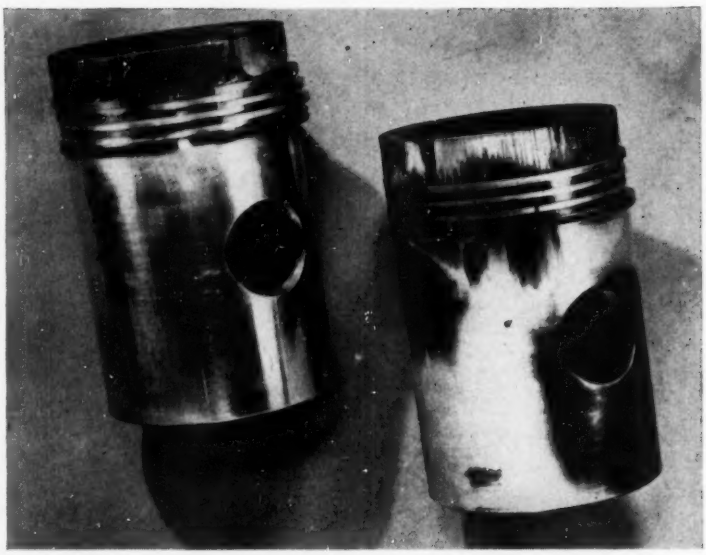
A lot of advantages, especially to the automotive diesel field, can accrue from turbocharger operation. Operators can take advantage of the simplicity and greater fuel economy inherent in the performance of turbocharged engines. Fuel savings resulting from better mechanical efficiency will be welcome but also this can be beneficial in increased range before refueling, or, conversely, a reduction in weight by carrying less fuel.

Perhaps most important is the promise of more power in a given size "package" or the same power in a smaller unit. Trends, both ways, are evidenced. For off-highway hauling, in places such as the Mesabi Iron Range, the cry is for more power for greater turn-around speed. On the highways, with gross weight limitations, the demand is for powerful but lower weight engines. These smaller turbochargers show promise of being the answer to these and other current problems.

What oil should I use—Regular, Premium or Heavy Duty? If Heavy Duty, what particular additive level do I need? What Grade? What about the new API Service Ratings?

The author has done an excellent job in providing a basis for the answers to these questions that are so frequently heard. The test is based on his comments at a recent Trucking Operations Forum sponsored by the American Trucking Associations, Inc., at Columbus, Ohio. In addition to giving a wealth of factual material, he outlines the new API Service Ratings.

The American Petroleum Institute, responsive to the requests of engine manufacturers and others, has recently changed definitions of Regular, Premium, and Heavy Duty motor oils, to designations based on service rather than oil type. We emphasize that this change *applies specifically to the automotive type engine*, either gasoline or diesel. The service ratings are *not* meant to apply to the larger engines. —Editor.



Satisfactory and unsatisfactory pistons resulting from CRC L-1 Single Cylinder Caterpillar Engine Test as part of qualification for MIL-O-2104 rating. Note freedom of rings in satisfactory (left) piston.

Which Lube Oil?

CURRENTLY there are seven types of lubricating oils with different performance characteristics available and being offered for automotive fleet operation. In many cases, the operator will defend to the death the use of his choice of oil, whatever the type. There is as much difference of opinion regarding motor oils as there is in religion and politics.

Unfortunately, a considerable degree of this difference of opinion exists within the petroleum industry as to the types of oils that are effective in different types of operations. Some of the opinions expressed here undoubtedly will differ from those expressed elsewhere.

New American Petroleum Institute designations define five different types of service, although the composition of the various types of oils previously offered remain the same. The purpose behind the new API system is to eliminate classifications based on oil characteristics and substitute classifications based on the several types of service generally encountered with automotive gasoline and diesel engines.

The author's interpretation of the type of oils which will be offered against the new API service designations is shown. It is fully expected that there will be considerable confusion and difference of opinion, particularly in the oil industry, for some time as to which type of oil to offer against which service designation.

Therefore, in the future as in the past, the author believes that consultation with the petroleum supplier as to the proper type of oil to use for the type of service involved will still be the best policy.

How Definitions are Established

In general, the various types of oils are defined by their performance in laboratory test engines under controlled conditions. Test procedures used in laboratory test engines are generally more severe than the anticipated service conditions for which oils are to be recommended. However, no test procedures duplicate any particular type of service to an exact degree and there is considerable thought that some revision of the procedures should be made to more nearly simulate the various types of service operating conditions.

Although "Service Designations" are to govern the oil to be used, it is still necessary to consider the definition of the oil in discussing how they will perform in the service for which they are recommended.

AUTHORS INTERPRETATION OF OILS WHICH WILL BE OFFERED AGAINST NEW A.P.I. DESIGNATIONS

Symbol	Military	Prior A.P.I. and Other	SERVICE CHARACTERISTICS	GENERAL BASIC CHARACTERISTICS
Service MS	2-104B* MIL-O-2104 Supplemental 1*	Heavy Duty	1. Start and stop service which can result in corrosive wear, oil ring plugging, mayonnaise type sludge, and fuel varnish deposits. 2. High temperature, over-the-road, heavy load operation.	Contains oxidation and bearing corrosion inhibitors plus effective quantities of detergent-dispersant agents.
Service MM		Mild Detergent Premium	High speeds, heavy or light loads, where bearing corrosion and ring sticking may not be a problem.	Contains oxidation and bearing corrosion inhibitors.
Service ML		Regular	Moderate speed driving at no severe high or low engine temperature operation (practically a non-existant service condition).	Straight mineral oil containing no additives.
Service DG	2-104B* MIL-O-2104 Supplemental 1*	Heavy Duty	1. Diesel engines in over-the-road service using relatively low sulfur fuels. 2. Diesel engines in city bus operation where excessive fuel soot and heavy ends of the fuel do not contaminate the crankcase oil.	Contains oxidation and bearing corrosion inhibitors plus effective quantitives of detergent agent.
Service DS	Supplemental 1* Supplemental 2*	Heavy Duty Caterpillar Series 2	1. For Diesel engines in low temperature service which might result in fuel oxidation deposits, excessive fuel soot, and mayonnaise type sludge as well as corrosive action from too low crankcase and cylinder wall temperatures. For certain Diesel engines using high sulfur fuel. 2. For certain super-charged Diesel engines and high output Diesel engines.	High additive oils containing oxidation and/or bearing corrosion inhibitors plus detergent-dispersant additive level equivalent to the Supplemental 1 or Supplemental 2 oils.

*Obsolete

Types of oils and conditions under which they receive their classification or definition are as follows:

A. Heavy Duty Oils

Mild Detergent—In the author's estimation, Mild Detergent oils should be classified as Premium oils. It is not believed there is sufficient detergent-dispersant additive level in the Mild Detergent oil to be any more effective than the oxidation and/or bearing corrosion inhibitor contained in Premium oils. A Mild Detergent oil will not pass the requirements of the old U. S. Army Specification 2-104B or any of the subsequent Army definitions of Heavy Duty oils.

U. S. Army Specification 2-104B—This specification is now obsolete as far as the Army is concerned, but there are a large number of operations where engines in heavy duty service are being very satisfactorily lubricated with this type of oil.

Basic requirements of this type oil and all of the subsequent Heavy Duty oils are that in addition to passing the CRC L-4 Chevrolet Engine Test, they must also pass the CRC L-1 Single Cylinder Caterpillar Engine Test.

The latter test is supposed to be a measure of detergency in an automotive lubricating oil. It is the only measure of detergency that is known and there is some question as to whether it is an adequate measure or whether it reflects only the performance of the oil under the prescribed test conditions.

MIL-O-2104—This is the latest U. S. Army Specification oil. Many oils which passed the old 2-104B specification satisfactorily passed the new requirement without any increase in additive level. The principal difference between the two tests lies in the characteristics of the fuel used. A comparison of fuels used for the 2-104B oil and MIL-O-2104 oil tests are shown below:

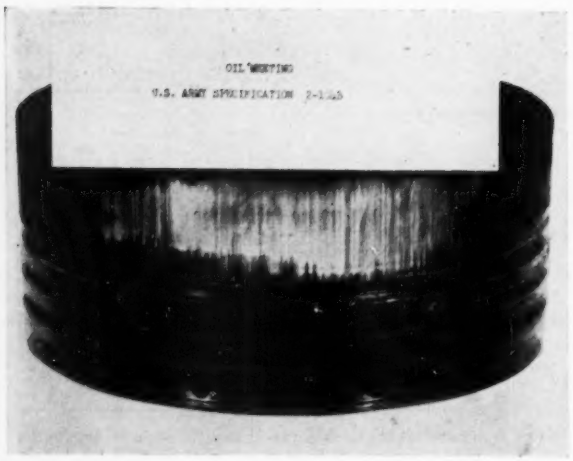
Quality	U. S. Army Spec. 2-104B	MIL-O-2104
Cetane No.	43-53	40-45
Sulfur, %	0.4 max.	0.34 min. (Natural)
Volatility		
90% Point, °F.	550-600	600-640
End Point, °F.	max. 675	650-690

The accepted standard for the L-1 piston has been established at a maximum of 25 per cent top ring-groove filling with not more than a trace of lacquer on or below the first land. Interpretation of this requirement is based on mature judgment by members of the Ordnance Reviewing Committee.

Obviously, over-all piston cleanliness will be considered; for example, ring groove plugging slightly in excess of 25 per cent may be acceptable in view of freedom from lacquer and vice versa. A piston should have this described appearance for qualification under MIL-O-2104. A satisfactory and an unsatisfactory Caterpillar piston are illustrated.

Supplemental 1 to U. S. Army Specification 2-104B—This type of oil is now officially obsolete and became so with U. S. Army Specification 2-104B. The general requirements of an oil meeting this specification were that in addition to meeting Specification 2-104B, it also had to pass the Single Cylinder Caterpillar L-1 Engine Test using a diesel fuel containing 1 per cent of sulfur.

In general, it might be said that oils meeting the Supplemental 1 classification contain approximately twice



Appearance of pistons after L-1 test for the first two, and Caterpillar 1-D procedure for the last using 1.0 per cent sulfur fuels and different type oils. The effect of additive level with such a fuel is strikingly apparent.

the detergent-dispersant additive level contained in 2-104B oils. While officially obsolete, this oil is currently receiving a great deal of attention, particularly in light-load, low-temperature operations, but also to a lesser degree in heavy-duty operations.

Supplemental 2 to U. S. Army Specification 2-104B—This type oil is also officially obsolete following U. S. Army Specification 2-104B, but it now is known by the definition of Caterpillar Series 2 Oil. The general requirements of an oil meeting this specification were that it fulfilled U. S. Army Specification 2-104B and, in addition, the Single Cylinder Caterpillar 1-D Engine Test procedure which is run in a supercharged engine using a 1 per cent sulfur fuel for the test.

In general, oils meeting this requirement contained twice the detergent-dispersant level of additive concentration of a Supplemental 1 oil and four times the concentration of a 2-104B oil. While, as mentioned, the Supplemental 2 oil is now obsolete, under the designation of Series 2 (Caterpillar), it is being recommended by at least three diesel engine builders where sulfur content of the fuel is higher than 0.4 per cent or 0.5 per cent.

To illustrate the effect of additive level in the Single Cylinder Caterpillar Test using a 1.0 per cent sulfur fuel, the wear table shown is very informative.

	WEAR		
Additive Level	Top Ring Gap	Cyl. Wall Long	Cyl. Wall Trans.
2-104B	.022"	.0026"	.0026"
Supplemental 1	.010"	.0004"	.0003"
Supplemental 2 (Series 2)*	.008"	.0003"	.0001"

*Caterpillar 1-D Procedure

B. Premium Oil

These oils should contain oxidation and/or bearing corrosion inhibitors. The principal feature in determining a Premium oil is to test it in the CRC L-4 Engine Test.

After this 36-hr. test period is completed, the engine is dismantled and piston skirts, the rocker arm cover plate, push rod cover plate, cylinder walls, and crankcase oil pan are rated for varnish deposits. The rating system allows a maximum score of 10 and a minimum of 0 for each of the items with a possible total of 50 points if no varnish deposits are present.

The rocker arm assembly, rocker arm cover plate, push rod cover plate, oil screen, and crankcase oil pan are similarly rated for sludge deposits for a total of 50 points if no sludge is found. This gives a possible maximum combined varnish and sludge deposit rating of 100.

C. Regular Oil

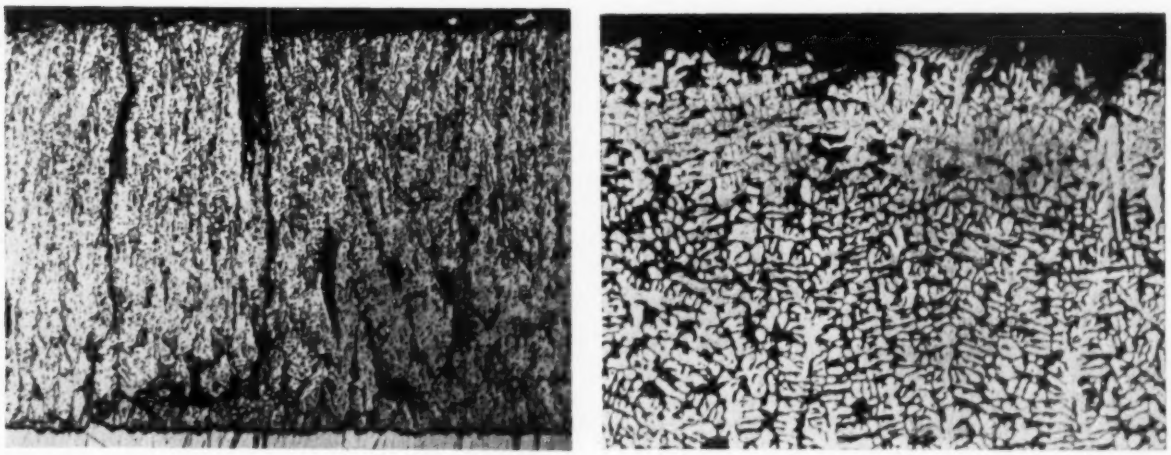
Regular oil is a mineral oil containing no additives and is not required to meet any laboratory engine, chemical, or physical tests.

Fields for Improvement

In general, improvement in operation from fuels and lubricants in field service can be divided into two categories—reduction of wear and deposits in high- and low-

TYPE OF OPERATION	SOURCE OF ENGINE DEPOSITS	NATURE OF ENGINE DEPOSITS	EFFECT OF ENGINE DEPOSITS
High Temperature (Heavy load, high speed, long-hop operation)	Engine oil oxidation	Varnish and lacquer Coffee Grounds (coke-like carbon)	Stuck rings Stuck wrist pins Stuck valves Stuck valve lifters Plugged oil screens

High Temperature Operation



Photomicrographs of bearings clearly illustrating the difference in appearance of fatigue and corrosion failure. Positive determination is only possible in this way.

temperature than in high-temperature operation and will be discussed later.

Deposits—High-temperature deposits originate from the oxidation of engine lubricating oil. (*see chart*) Corrosion of alloy-type bearings can also be a result. Low-temperature deposits are not the result of oxidation, but are the result of the contamination of the lubricating oil with products from the combustion chamber.

There are two theories as to the formation of coffee-ground sludge. One is that it is formed by lubricating oil which is splashed onto the underneath side of the piston and there oxidizing, carbonizing, and falling back into the crankcase in relatively small granular particle size. The second theory is that it is formed when fresh unoxidized oil is put as make-up oil into a crankcase containing used, partially-oxidized oil and that some of the oxidized oil molecules are insoluble in fresh oil and are precipitated in relatively small granular particle size.

In spite of the engine tests to determine whether an oil will or will not produce high temperature deposits, there are a number of oils which will pass the L-4 procedure and the Caterpillar L-1 test in a satisfactory manner, but will not perform with equal satisfaction in the field. It must be remembered that any specification is a minimum quality line. It does not guarantee that one oil will not be better than another.

As an example, parts were taken from an engine used in over-the-road service. This engine had travelled 5100 miles on an approved good 2-104B oil. Considering the appearance of this engine at the end of 5100 miles, it was doubtful if it could have been operated for an additional 5100 miles without some engine malfunction occurring. Another approved heavy duty oil was also used in this particular operation and approximately the same results were obtained.

On both of these oils after 1500 miles of operation, the used oil analysis revealed that viscosity had increased due to oxidation from an SAE 20 to an SAE 50 oil. When a third 2-104B oil was used in this operation, analysis of the used oil after 1500 miles of service also showed an increase in viscosity, but only one-half of an SAE grade.

The third Heavy Duty oil used, with relative satisfaction, passed all the new MIL-0-2104 requirement without any additional concentration of additive. It is known that one of the two other oils required additional concentrations to pass the new military requirement, and based on service shown, it is quite possible that the second 2-104B oil also required additional detergent-dispersant additive to qualify.

Corrosion—In many cases where bearing failures are reported in the field, the first reaction is that the oil has corroded the bearing. Babbitt bearings and Morraine

TYPE OF OPERATION	SOURCE OF ENGINE DEPOSITS	NATURE OF ENGINE DEPOSITS	EFFECT OF ENGINE DEPOSITS
Low Temperature (Light load, low speed, short-hop operation)	Water, fuel soot, lead salts, carbon—mixing with oil	Mayonnaise-type sludge	Rusted valve springs, timing gears, chains Plugged oil screens
	Fuel	Varnish Fuel Soot	Plugged rings and oil screens Piston varnish Stuck valves and lifters Rocker shaft varnish

Low Temperature Operation

bearings are not susceptible to corrosion. Copper-lead and cadmium-silver bearings can be corroded if the lubricating oil is such that corrosive organic acids are formed. Visual examination of a failed bearing in the field cannot determine whether corrosion caused the failure. The only positive way is to have the laboratory cut through the failed area, etch, and examine it under the microscope.

An illustration shows a copper-lead bearing suspected in the field of having failed due to corrosion. However, upon laboratory examination, the mixture of lead and copper is in good proportion throughout the layer of bearing metal. This bearing fails due to fatigue. Also shown is a photomicrograph of a bearing which has failed due to corrosion, and it may be seen that the lead is missing from the black voids between the particles of copper.

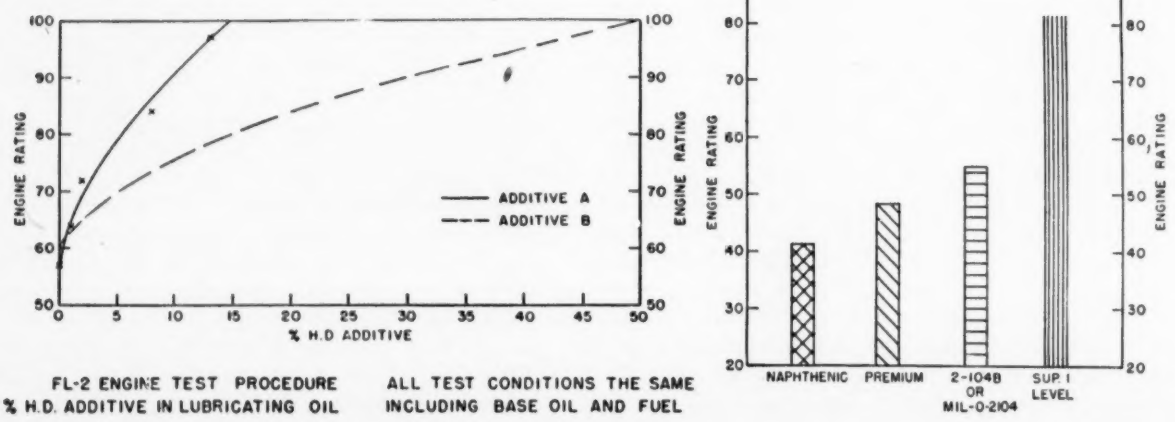
Light-Load—Low-Temperature Operation Neglected

It is realized that the bulk of the miles on engines in over-the-road hauling are put on the vehicles in this type of service. Nevertheless, many over-the-road trucking companies have as many or more vehicles in city delivery as they have in highway hauling. These city delivery trucks are exposed, to some degree at least, to the same operating conditions as bakery fleets, dairy fleets, taxicabs, and other similar types of service.

Prior to the fall of 1947, almost all of the known development work on lubricating oils was aimed at engines engaged in high temperature, heavy-duty operation with little development work on lubricating oils which would satisfy the requirements of the light-duty, low-temperature service. Contrary to popular conception, it is this type of operation which imposes the severest service on engines.

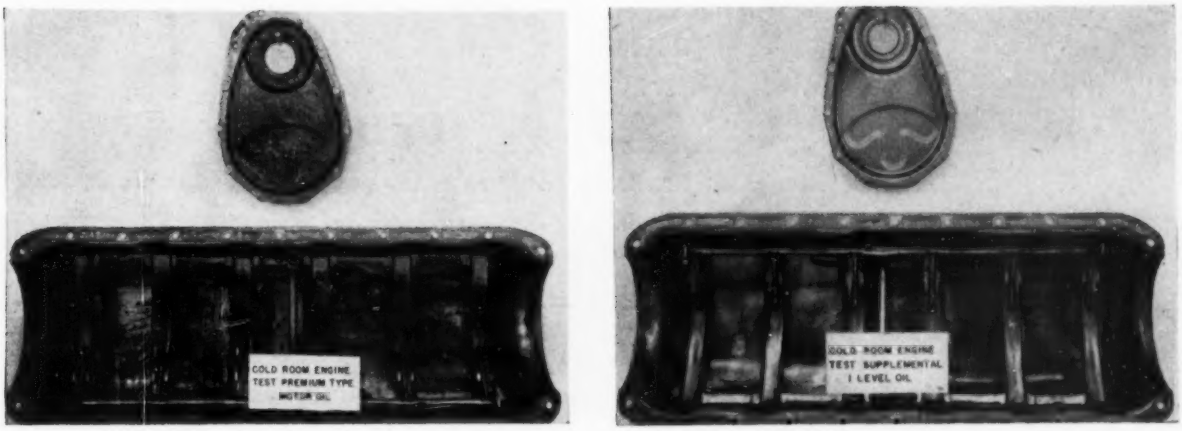
Therefore, it is ironic that the final criterion of automotive engine lubricating oil quality is performance under high-temperature conditions in laboratory or in diesel engines, while most units today are gasoline engines. All of the engine performance tests of the various military specifications for lubricating oils include a severe diesel

The graph at the right shows the comparitive ratings (dirt) with various oils after 30,000-mile test period in salesmens cars. Superiority of high additive level oils in this type service is apparent.



FL-2 ENGINE TEST PROCEDURE
% H.D. ADDITIVE IN LUBRICATING OIL

ALL TEST CONDITIONS THE SAME INCLUDING BASE OIL AND FUEL



Comparison of timing gear case and oil pan of cold room test engines, one using a Premium oil and one a Supplemental 1 oil.

engine test. The gasoline engine test included in these specifications is a high-temperature test but one relatively easy to satisfy.

There are no light-load gasoline engine tests in military specifications, although most military vehicles operate at light load a great percentage of the time. Even the latest military specification for lubricating oil, MIL-0-2104, does not recognize the existence of light-load, low temperature requirements. Fleet operators, however, regardless of their operating conditions, have purchased, and are purchasing, oils whose quality is based only on their ability to pass high-temperature gasoline and diesel engine requirements.

During the war a great many Army engines, both in this country and overseas were found to be in very dirty condition despite the fact that they were being lubricated with U. S. Army Specification 2-104B oil, a heavy duty oil.

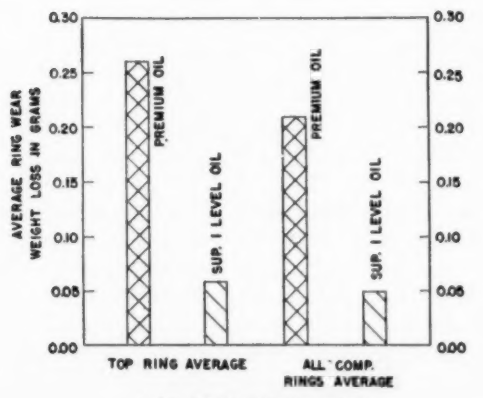
This created quite a furor because it was one of those things that couldn't happen with a heavy duty oil. However, it had happened and studies were instituted which eventually led to a review of the problem from the fuel angle. A laboratory test using a Chevrolet engine and a test procedure approximating, but not quite the same nor quite as severe as the conditions encountered in the Army post, camp, and station type of service, was developed and modified. Later it became the CRC FL-2 Engine Test Procedure in which oil temperatures were held at 165° F.

Gulf varies this method to hold the crankcase temperature at 155° F., as it is believed 165° F. is too high. As a matter of fact, 155° F. is too high to simulate low-temperature operation, but is as low as the crankcase oil temperature can be maintained under the test conditions.

After the 40-hour period the engine is dismantled and, as with the examination of the L-4 Engine Test, the piston skirts, push rod cover plates, cylinder walls, and other parts of the engine are rated for varnish and also for sludge. The rating system is the same. There is no evaluation of bearing corrosion in this test as the crankcase oil temperatures are not high enough to give trouble.

The low-temperature chart shown shows the type of deposits which may be obtained from light-duty, low-temperature operation. The fundamental reason why light-duty operation produces deposits and wear is that the temperature of the crankcase and cylinder walls is too low. Temperature indicated on the dashboard is all to frequently not a true indication of cylinder wall and the crankcase temperature. With a thermostat, it only takes a few city blocks for the water in the head to become hot enough to give a satisfactory reading and this is misleading.

In intermittent, light-duty service, the engine does not completely warm up. If the cylinder wall temperature does not reach at least 140° F., water and inorganic acids from the combustion process will form, and rust or acid corrosion will occur. If the crankcase oil temperature does not reach at least 140° F., excessive dilution, and in many instances water, will remain in the crankcase oil.

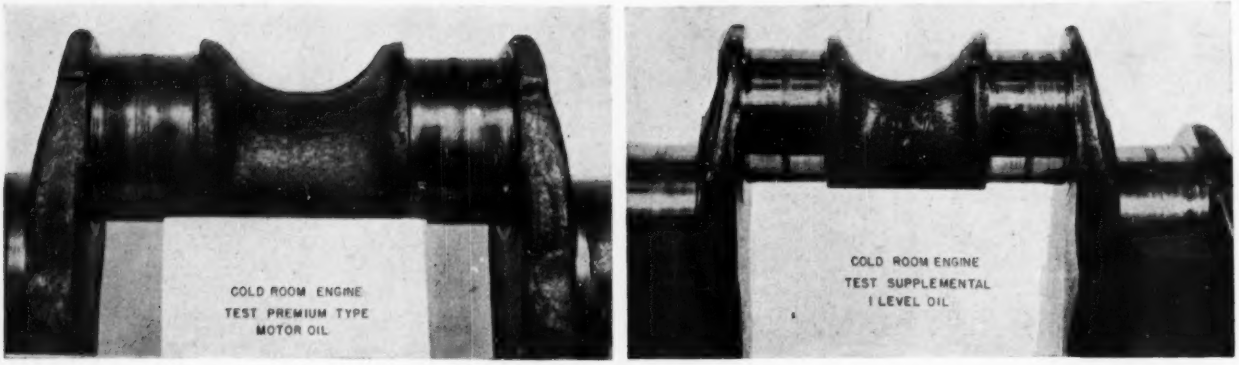


COLD ROOM ENGINE TEST

EFFECT OF DETERGENT OILS ON WEAR CHARACTERISTICS

Effect of Additive Levels

About five years ago, the Gulf Research & Develop-



Section of crankshafts operated under the same cold room conditions, but using different oils as indicated. Note the cold corrosion of journals in the left picture.

ment Company began experimenting with heavy duty additives in high concentration in the CRC FL-2 Engine Test Procedure using so-called "dirty" fuels. The chart shows the effect on engine rating (dirt) of various concentrations of two different heavy duty additives in the same base oil using a dirty fuel which, with the reference heavy duty oil in the CRC FL-2 Procedure rated approximately 58 to 60. As additive concentration increases, the engine rating goes up. With one type of additive the improvement in engine rating is spectacular. While with the other it is more gradual

The curves shown indicate that as additional heavy duty additive is used, engine rating improves considerably with each added increment. However, in field tests under actual operating conditions where the engines are rated in the same manner as in the laboratory, and by the same personnel, there seems to be a plateau of additive concentration which must be reached before any appreciable effect on the engine deposits can be observed. In other words, up to a certain concentration of heavy duty additive any lesser amount appears to be ineffective in minimizing engine deposits and sludge. Based on field test work, it appears that the concentration of detergent-dispersant additive in the ordinary type of heavy duty oil is only mildly effective in this light-load operation.

Having established in the laboratory the effectiveness of high concentrations of detergent-dispersant additives, Gulf initiated a field test in approximately 160 engines in salesmen's cars using approximately 19 combinations of lubricating oils and fuels. This test started approximately four years ago. The performance of four of these combinations which appear to be most illustrative of the type of oil required for light load, low temperature operation are shown in the accompanying bar graph.

From the comparison of these various oils at the end of the 30,000 mile test period, the superiority of the Supplemental 1 level oil is clearly shown. Other concentrations of heavy duty additive in lubricating oils were used in this field test. Higher concentrations of additive did not appear to be any more effective than the Supplemental 1 level. Supplemental 2 to U. S. Army Specification 2-104B was not tested as laboratory engine tests indicated little additional or economical improvement could be expected from excessively high concentrations. Lower concentrations, however, were tested. From the data on all oils, it is believed that the Supplemental 1 level of additive concentration is the optimum based on performance and economy.

Cold Room Tests

Another very interesting feature of the high additive oils are the beneficial effects of reducing wear and rust. Gulf has developed a severe cold room engine corrosion test. The correlation between this test and field operating conditions is unknown. However, this laboratory cold room engine corrosion test, while accelerated, should certainly indicate a trend in low-temperature, light-load service.

From the data shown in the next bar graph, it may readily be seen that Supplemental I level oil gives only about 20 per cent of the wear that is obtained with Premium type motor oil. In the chart below are shown the results of rust formation with a Premium type oil and a Supplemental I type of oil in this same engine corrosion test. These data illustrate the excellent rust preventive characteristics of the high-additive oils.

ENGINE CORROSION TEST
Low-Temperature Operating Condition
Rust Characteristics

Item	Premium Oil	Supplemental 1 Level Oil
Oil screen housing	Light	Nil
Cylinder walls	Medium	Trace
Rocker arm cover	Heavy	Nil
Timing case	Heavy	Trace
Side cover plate	Heavy	Nil

To pictorially illustrate the wear and rust characteristics of Premium oils as compared to high-additive oils, the timing gear case and the oil pan from this test on a Premium oil as compared with these operated with a Supplemental I oil are shown. Also shown is a section of a crankshaft operated in this engine test on a Premium oil and one operated at the same time and under the same conditions on a Supplemental I oil.

It is believed that these last two pictures are quite

LUBRICATING OIL RECOMMENDATION FOR OPTIMUM ENGINE OPERATION

(Minimum Wear—Minimum Deposits)

Symbol	General	Specific	LUBRICATING OIL RECOMMENDED
Service MS Service DG	1. Gasoline and Diesel engines in light load, low temperature operation where fuel oxidation deposits excessive fuel soot, sludge, and wear may occur. 2. For gasoline and Diesel engines in high speed, high temperature over-the road, heavy load operation. For Diesel and gasoline engines in city bus operation.	1. All types of delivery fleets, such as truck delivery, bakery fleets, dairy fleets, etc. 2. For gasoline and Diesel engines in trucks and buses operating over-the-highway under heavy load. Also, Diesel engines in intermittent as well as over-the-road service where special problems of fuel and wear may be encountered.	1. Supplemental 1* 2. MIL-O-2104 2-104B Supplemental 1*
Service MM	High temperature, light duty engines	Truck at high speed over-the-road service carrying light loads. Passenger cars in high speed over-the-road service.	Premium Mild Detergent
Service ML	Moderate speed driving with no severe high or low engine temperatures or high or low load conditions.	Practically a non-existant type of service. However, includes possibly older engines, engines in poor condition, etc.	Mineral oil with no additives.
Service DS	1. For Diesl engines in low temperature service where fuel oxidation deposits, excessive fuel soot and sludge and wear may occur. For Diesel engines operating on medium to high sulphur fuel. 2. For Diesel engines operating on high surfur fuel, for certain high output or super-charged Diesel engines.	1. Intermittent stop-and-go operation of Diesel engines. Excessive use of throttle, such as in city bus operation and city delivery service. 2. For certain makes of Diesel engines which due to high output or super-charging, the manufacturer recommends a Supplemental 2 (Series 2) oil. For certain Diesel engines which must operate on Diesel fuel having sulfur content ranging from 0.4% to more than 1.0%.	1. Supplemental 1* 2. Supplemental 2* (Caterpillar Series 2)

*Obsolete

striking in showing the effect and alleviation of cold corrosion of bearing journals either from water or inorganic acids formed in the combustion process. The high alkalinity of some high additive oils tends to overcome this acid action and thus reduce wear.

Correcting a Misconception

One of the most persistent ideas regarding heavy duty oils regardless of the concentration of additive is that they will wash or clean deposits already formed in the engine. It is true that an engine in the laboratory may be operated in such a manner as to purposely form oil deposits and that when this same engine is subsequently operated on a heavy duty oil, the deposits will be all or partially removed.

It is the author's experience, however, of never having seen an engine in the field which failed due to heavy duty oils washing down deposits or causing them to migrate. Many of such instances have been reported, but it is believed that if these complaints had been studied thoroughly, some other reason for failure would have been found.

When heavy duty oils first appeared, most of the experience on them had been laboratory experience, including laboratory engine tests, and, as mentioned heavy duty oils in laboratories can be made to clean up engine deposits. However, in field service it is believed that these deposits are laid down over a relatively long period of time and that they continue to oxidize even though they have passed from the oil-soluble to the oil-insoluble state and are plated-out on engine parts. They become so firmly fastened to the engine and become more and more insoluble as they oxidize toward complete reduction to carbon. Heavy duty oils will not cleanse them to any appreciable degree.

It would appear that since the ordinary heavy duty oil cannot keep fuel deposits from forming in the first place, that they would hardly be able to remove them once they have formed. There is some evidence to indicate that slow cleansing of oil oxidation products may be accomplished by heavy duty oils, but the rate of removal is so slow that no dangerous condition is produced. Gulf has tried without success to make dirty engine fail using heavy duty oils with additive concentrations as high as 50 per cent.

Summary

The purpose of this article has been to outline the current status of various oils, particularly those of the additive type. It is intended primarily to discuss and explain the meanings of the various types of engine oils, their specifications and their expected performance.

Attempt has been made to explain some of the mechanics of deposits, sludges and corrosion, as well as to point out some of the service conditions that require greater attention. It is hoped that the preceding information will stimulate a little thinking on the subject of which lubricating oil is best for a certain engine in a certain type of service.

The purpose of the article will be served if the preceding information, in view of the number of types of oils in various grades, will help to answer the important question, "Which Lube Oil?".

DIESEL BRIEFS

Rocky Mountains Go Diesel

A new era of mountain railroading in Canada is being unfolded as modern streamlined Canadian Pacific Railway diesels, the first to go into service in the Rocky Mountains, replace steam locomotives, longtime conquerors of the steep slopes and rugged mountain wilderness.

Pictured are two of the 48 new diesel units which the railroad has acquired since last fall to dieselize train operations in the Rockies and Alberta foothills between Revelstoke, B. C. and Calgary, Alta., as they pull a passenger train past towering peaks near Lake Louise.

Passenger and freight trains on this run, one of the toughest in the world, are being given diesel power as part of the railway's five year dieselization program. An additional 18 road and switch engines will be delivered before this fall to completely dieselize the area.

New Oil Field Discovery

What appears to be a new oil field discovery in Saskatchewan, Canada, was made public recently by Socony-Vacuum Oil Co., Inc., on the basis of several drill-stem and production tests.

The wildcat, is Socony-Western Prairie Midway No. 1, located in southwestern Saskatchewan, 15 miles away from a field discovered last January. In a recent 90-min production test, the well flowed 21 gravity crude at the rate of 288 barrels per day through a 3/8-in choke, from a depth of 3450 ft.

Power Plant Cuts Costs

The municipal power plant in Osawatomie, Kansas is saving $20,000 a year since the installation of a 1750-hp four-cycle Nordberg dual fuel engine.

Fuel costs, since installation of the engine, totals 2.87 mills per kwhr as compared with the previous 6.90 mills per kwhr.

Mexico "Stamps" Diesels

The Mexican government is currently issuing postage stamps commemorating the revolutionizing railway service of diesels, on recent 10 and 20 centavo issues.

Pakistan Youths Train On Erie Railroad

Two young men from Pakistan are taking an 18-month apprenticeship at the Erie Railroad's diesel shops in Marion, Ohio.

They are here to learn diesel maintenance and repair, as part of a group of 25 from their country for apprenticeship training in this country. The Pakistan government is paying their expenses.

The new country has been changing from steam to diesel power because of the difficulty in obtaining coal. Ten road freight diesels are now in operation there, with 23 more on order and more scheduled to follow.

FPC Authorizes More HP

The Federal Power Commission has approved compressor station changes, already partly carried out by the Texas Eastern Transmission Corp. of Shreveport, La. The changes permit the company to construct 12 compressor stations with a total of 102,540 installed hp in lieu of the 13 stations with an aggregate of 96,400 hp as previously authorized.

Gar Wood Industries, Inc. Merges with United Stove Co.

Gar Wood Industries, Inc., manufacturers of truck, tractor, and road building equipment, merged recently with the United Stove Co. of Ypsilanti.

United Stove will be operated as a subsidiary company and will continue to manufacture its present products, fuel oil burners and automotive parts. In addition, the facilities of the company will be used for manufacturing operations now conducted by Gar Wood.

DIESEL BRIEFS

Railroads Increase Fuel Oil Purchases

For the first time in history, last year's railway expenditures for fuel oil exceeded their expenditures for coal. Twenty years earlier, in 1931, about $6 were spent for coal for every dollar spent for fuel oil. Ten years ago, in 1941, more than $3 were spent for coal for every dollar spent for fuel oil. But last year, $1.18 were spent for fuel oil for every dollar spent for coal.

The figures, which were recently released by the American Association of Railroads, prove the point made in our April issue that the trend to dieselization of railroads is increasing as railroads realize that diesels do one-third more work at about one-half the cost of steam locomotives.

Fuel purchases for diesel fuel oil increased more than 33 per cent. In 1950, a total of $171,941,000 was spent for diesel fuel oil as compared to $228,893,000 spent in 1951.

New Alco Film

"The Alco Products Story", a new industrial movie based on the development and manufacture of products for the oil, chemical and power industries, has just been produced by the American Locomotive Company.

The film demonstrates engineering and production teamwork in all stages of manufacture. It describes how products are developed and how facilities, machines, and manpower are coordinated for efficient output.

Prints of the film are available to business groups and professional engineering societies on request.

Show Biz Powered By Diesel Generator

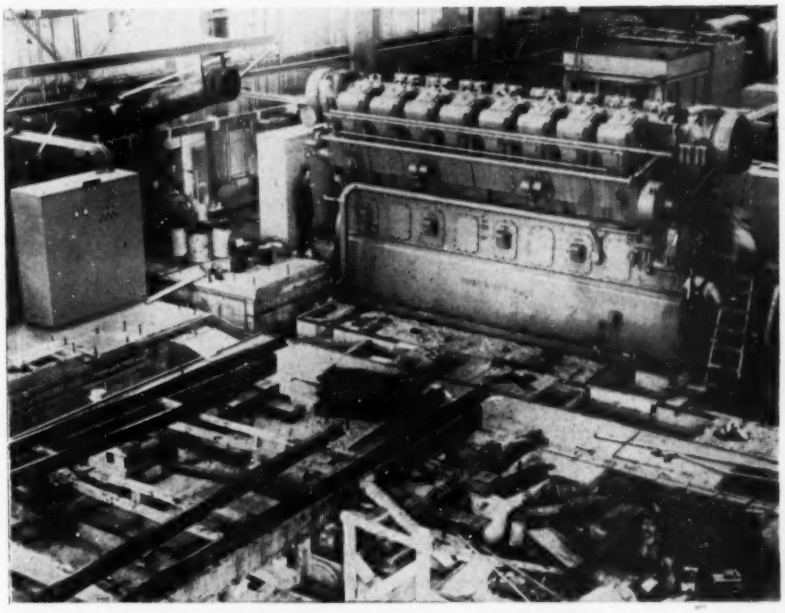
When the Royal American Shows ordered two 200 kw diesel electric sets for its midway power system, recently, the owner requested $500 worth of chrome plating for such parts as the valve covers and side inspection plates.

The chrome on the units helps to catch the eye of the carnival's patrons in both the U. S. and Canada. The power wagons are stationed prominently on the midway and are called the "extra attraction."

Catching the eye of diesel men, however, is the installation of a highly portable 13,000-lb electric set in which the generator is not close connected to the engine housing. The engine must not go more than .017 of an inch out of line with the generator.

The equipment must be extremely portable, since the carnival moves thousands of miles a season, and in the haste of departure is subject to much abuse. Two Caterpillar D375 electric sets, installed at Tampa in March have pumped current into the 1000 kw circuits, with nothing as yet being added or altered.

They were installed because Royal American needed more power per wagon. The company also wanted to avoid stringing more wire. The generators were hooked in parallel, so that if one set should go out, the other units would instantly pick up the plant load.



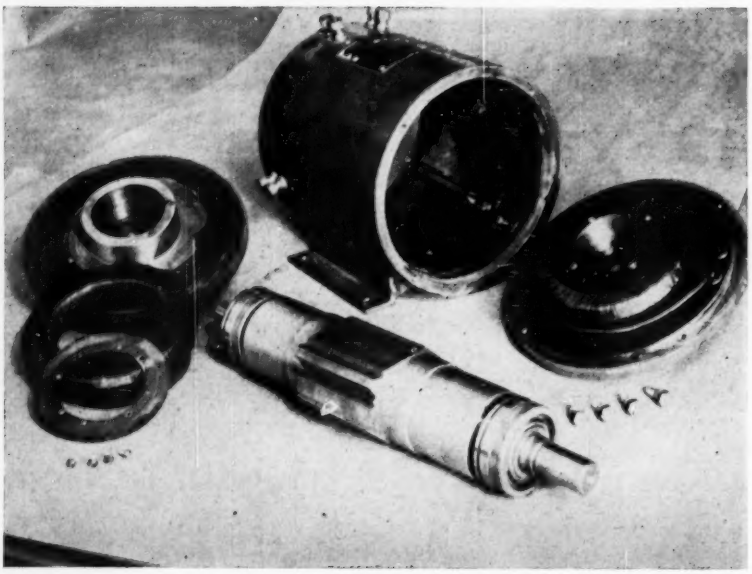
100-Ton Units Installed

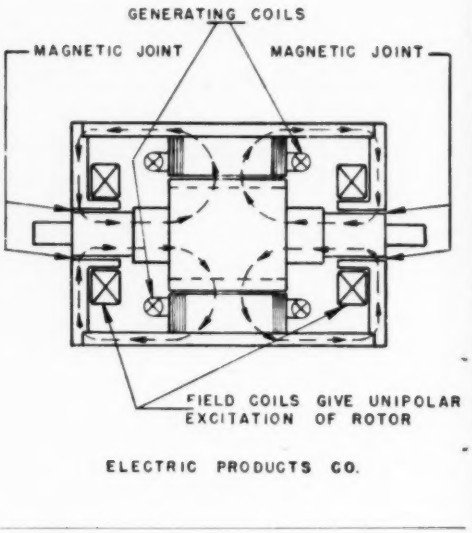
At the Reynolds Metals new San Patricio aluminum ore reduction plant, 42 Cooper-Bessemer engines (each rated at 2500 kw), were recently installed.

In order to facilitate installation, the units were shipped almost entirely assembled, less intake headers and platforms. Temporary skid rails were erected running along the entire length of the buildings at right angles to the permanent railroad track.

Engines were jacked up from the cars, and skid rails were placed beneath them. After lowering the engines to the skid rails, the engines were winched along the skid rails into position over the proper foundation bolts.

Using this method of installation, a crew of eight men were able to unload, skid, and set an engine on its foundation in approximately four hours.





Developing the Pulse Generator

*By Sidney Miller**

Great progress made in the past few years in the development of high-compression natural gas engines has demanded an equally rapid advance in the design of electrical ignition systems capable of reliably firing such engines.

Compression pressures of 500 to 600 psi are now commonplace engine design figures. The ignition problems which arise as a result of the greater charge density, the leanness of the mixture, and the capacitative loading of the high tension leads caused by shielding requirements have been many and difficult of solution.

As a result of a great amount of field testing, it became increasingly evident in 1946 that the reliability of electrical ignition systems suitable for application to large natural gas engines was limited by the life expectancy of the contact points used to interrupt the ignition transformer primary current. Since all systems commercially available at that time employed breaker points, it was decided that if optimum ignition service life was to be obtained a new type of system without breakers must be developed.

The breaker in a conventional ignition system is used only to cause a rapid change in flux in the ignition transformer core by interruption of the primary current. This rapid change of flux linking the transformer secondary induces therein the high voltage necessary to break down the spark plug gap. A pulse of current having a sufficiently steep wave front will, if supplied to the transformer primary, simulate the transient condition obtained with a breaker system. The initial work, therefore, is the development of a breakerless ignition system centered about the design of a generator to produce these current pulses.

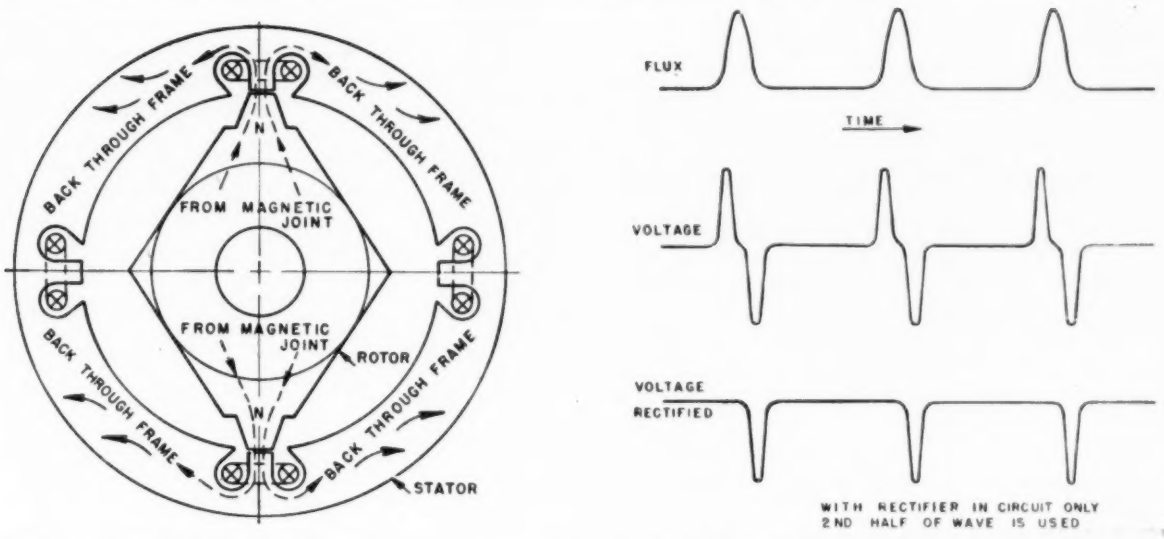
The first design of a practical pulse generator, as proposed by D. I. Bohn, Chief Electrical Engineer, Aluminum Company of America, and built by The Electric Products Company, is shown in Fig. 1. Referring to the illustration, it will be noted that with the voltage wave applied to the primary of the ignition transformer, two sparks result for each flux pulse.

It is well known that high-tension distribution on large engines often results in rapid erosion of spark plug electrodes due in part to the high peak currents caused by the large distributed capacitance of the long high-tension leads. D. I. Bohn has shown that this spark plug erosion is minimized by the use of series resistors of values up to ½ megohm located at the plug terminals.

In order, however, to further protect the system from plug erosion troubles, and to obtain the most precise spark timing, it was decided to eliminate the first spark of each firing cycle by the use of a half-wave rectifier in the ignition transformer primary circuit. The output voltage wave thereby became unidirectional as shown, and gave single spark performance.

The next step in our development program was aimed at obtaining an even greater degree of dependability by making the generator self-excited. A magneto-type generator was de-

* *Vice-president in charge of engineering, American Bosch Company, Springfield, Mass. Abstract of a paper presented by the author at the Oil and Gas Power Division, ASME, Conference in Buffalo, N. Y. in June, 1952.*



Along with the higher compression ratios in modern gas engines came the need for better and higher output ignition systems. Here is the development story of one answer to the problem —the pulse generator.

Fig. 1 **FIRST PRACTICAL PULSE GENERATOR** having stationary field windings supplied with current from a separate DC source to provide axial excitation of the rotor core. Unipolar magnetization characteristics are apparent in the schematic. Also shown are the typical wave shapes (pulses) of the open circuit flux and primary voltage, before and after rectification.

signed and tested. The magnetic circuit of this unit is illustrated in Fig. 2.

It will be noted that the stator carries two pairs of generating windings which are swept by the 4-alternate-pole rotor. These pairs of coils are designed to supply ignition energy to the two banks of spark plugs on a dual-ignition engine and are shifted in phase to provide a fixed firing differential between the two banks. Since opposite windings are in phase, they may be used individually, in series or in parallel.

This self-excited machine gave very satisfactory output on a two-spark-per-pulse-cycle basis; however, with the alternately opposite sense of the flux pulse produced *(See Fig. 2)*, the system was not suitable for use with a rectifier because of the resulting uneven firing intervals. Since the use of a rectifier to reduce the output to a one-spark-per-pulse basis and provide the most precise ignition timing was deemed necessary by some engine designers, further development was indicated.

In order to utilize fully the available magnet energy by retaining the complex flux reversal shown in Fig. 2, the design shown in Fig. 3 was evolved. Open circuit flux and primary voltage pulse characteristics are also shown.

The first production application of this unit was made on an 11-cyl radial 2-cycle natural gas engine. *(Nordberg engines at Alcoa's Point Comfort, Texas plant—Ed.)* The ignition generator is in this case driven at 2¾ times engine speed which, with the 4-pole rotor, gives 11 sparks per bank per crankshaft revolution. The firing differential between plug banks is 7.27 crank degrees. The high-tension distributor consists of two decks of jump spark electrodes driven at crankshaft speed; each deck supplying one of the two plugs per cylinder. The ignition transformer is, of course, specially matched to the generator. Typical performance data of the complete system is shown.

Performance of ABC Bohn-type Magneto Generator with rectifier—two generating coils in series.

Engine RPM	Transformer Kilovolt Output
180	11.0
300	18.0
360	25.0

Since long high-tension cables are used, current-limiting risistors of ½ megohm are used at the spark plug terminals. In this connection it should be mentioned that current-limiting resistors for spark ignition systems must be measured under actual voltage impulse conditions, since the ordinary radio-type resistor of any resistance value will exhibit practically no resistance during the transient current interval of gap breakdown.

Since the system just described made use of separate engine drives for the generator and distributor, the consolidation of generator and distributor into a single unit was the next logical design step. The combination unit of generator, distributor, and gear reduction is shown in Fig. 4.

The gear reduction section between generator and distributor is so designed as to allow, by proper ratio choice, application of the unit to either 2- or 4-cycle engines of 12 cylinders or less.

Low-Tension Developments

The use of a breakerless pulse generator for ignition purposes is not

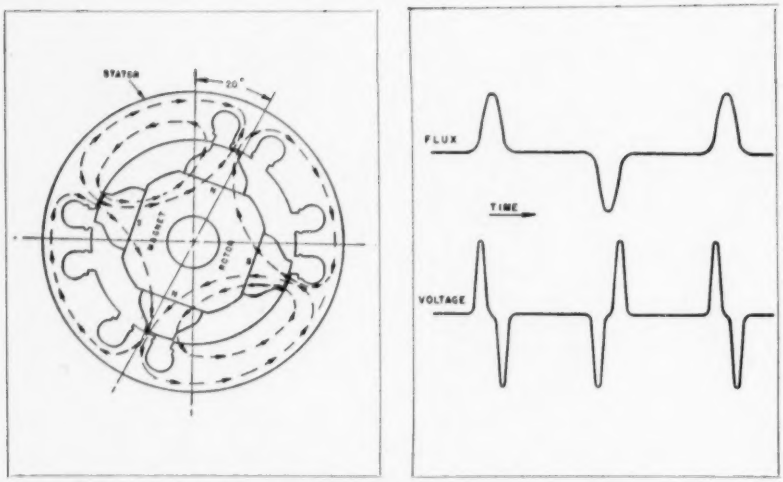


Fig. 2 **FOUR-MAGNET PULSE GENERATOR** disassemble and also the flux circuit as well as voltage wave forms are also shown. Note reversal of flux and its effect on voltage wave.

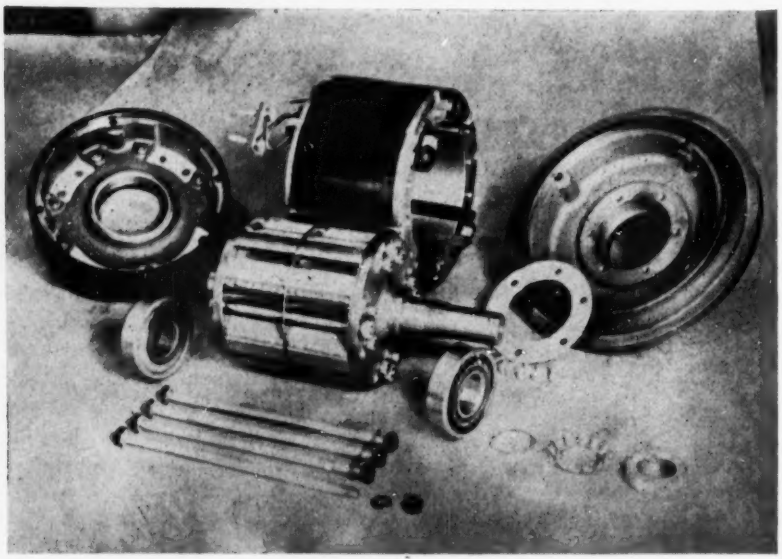
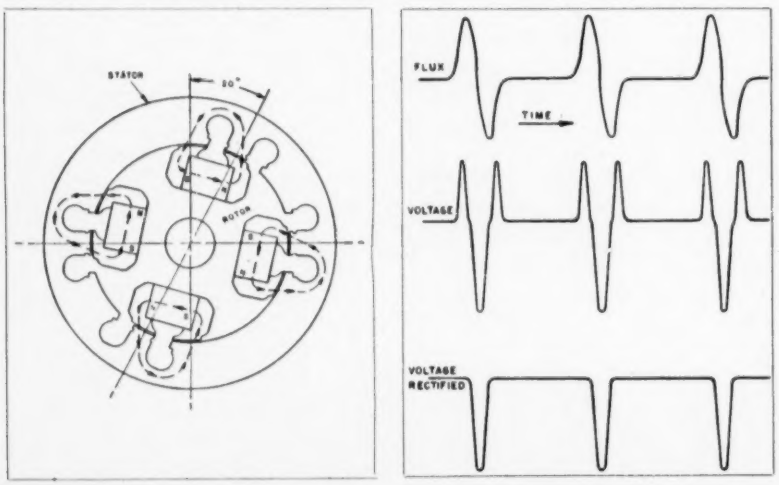


Fig. 3 **FOUR-MAGNET PULSE GENERATOR** disassembled and also the flux circuit as well as the open circuit flux and primary voltage pulse characteristics are shown. This improved version utilized fully the available magnet energy and permitted rectification with precise timing.



new. In the late nineteen twenties, American Bosch produced a high-speed motor-driven magneto operated without an interruptor or breaker, to generate high-voltage ignition sparks for oil burners operating in sections having only DC power. The Bohn-type generator, like the oil burner magneto, depends on a relatively high speed of rotation to provide the rapid flux change necessary to generate steep-front voltage pulses at the proper energy level.

This is no disadvantage when used with the high-tension distribution type of unshielded ignition distribution system, certainly one of the most simple systems giving extremely good and dependable performance. However, it is sometimes unsuitable for use on engines installed in locations requiring low fire-hazard equipment.

When such a system is used on an engine for pumping service in the gas fields and the explosion-proofing requirements dictate complete shielding, the secondary lead capacitance may increase so greatly that a very large energy storage is experienced in the long high-tension leads. The use of series current-limiting resistors is mandatory in these cases because of the high peak currents of the capacitance discharge spark obtained, and the generator and transformer must be capable of supplying the additional energy to charge this lead capacitance.

A low-tension distribution system with its possibility of elimination of the distributor and the great reduction in high-tension lead length was, we found, a definite objective of some engine designers. A pulse generator for use with low-tension distribution may act also as a distributor by the incorporation of a timed generating coil for each corresponding engine cylinder. A single rotating magnet sweeping these generating coil pole faces will produce a low voltage pulse in each successively. These pulses are fed to separate ignition transformers—one located near each spark plug on each cylinder.

Obviously, a pulse generator of this type is required to operate at much lower speeds than the corresponding unit for high-tension distribution. In the case of a 2-cycle engine, the gen-

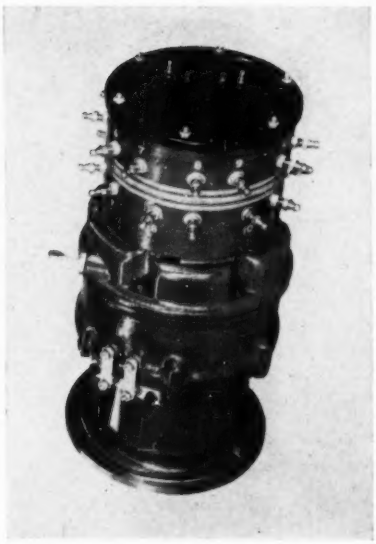


Fig. 4 **COMBINATION GENERATOR, DISTRIBUTOR AND GEAR REDUCTION** eliminated the necessity for separate drives for generator and distributor.

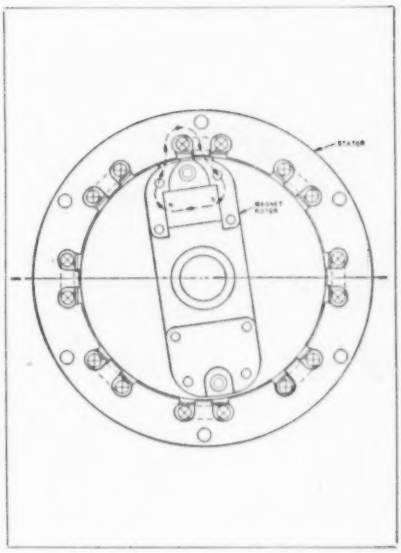


Fig. 5 **SCHEMATIC OF LOW-TENSION PULSE GENERATOR** showing the flux circuit. Coils are connected to ignition transformers on each cylinder in proper firing order. Thus, rotor serves also as distributor.

erator drive must be at engine crankshaft speed; and in the 4-cycle engine, at one-half engine crankshaft speed. Starting cranking speeds of these engines may be as low as 75 rpm. This means that in the case of the 4-cycle engine, the generator must deliver sufficient energy to fire the engine at shaft speeds as low as 37½ rpm.

As a first approach to the problem, a generator was designed which consisted of a single rotating magnet sweeping several generating coil pole faces, as shown in Fig. 5. This unit showed excellent performance above 150 generator rpm but lacked output at the lower starting speeds.

The possibility of obtaining a system completely free from contacts, brushes, or jump-spark gaps prompted the assembly of a "king size" double-decker as shown in Fig. 6. This unit allowed a reduction in starting generator speed to 75 rpm. Although the requirement of a breakerless system for 2-cycle engines had been met, the starting speed for a 4-cycle engine was double the allowable.

Ample magnet energy was available. The problem resolved itself into the development of some means for obtaining more rapid flux reversal. As a result of intensive study on this problem, a design was created which retained the advantage of the single magnet and multiple generating coils and yet produced the rapid flux reversal as necessary for good output at low speeds. This was accomplished by interposing an inductor rotor or "flux reverser" between the magnet rotor and the stator. (*See Fig. 6 for section.*) This inductor rotor was driven from the magnet rotor shaft through a planetary gear train and rotated at several times the magnet rotor speed.

The two rotors were carried on independent bearings and separated from the gear compartment by an oil seal. Also shown, is the action of the inductor rotor in reversing the flux through the generating coils as the drive shaft is turned. It will be noted that through the action of the inductor rotor, several flux reversals were obtained at each firing position which gave an output voltage wave as shown.

It will be seen that under certain conditions of low firing potential requirement, twelve or more sparks would be produced, while under more rigorous firing potential demands the number might be reduced to four. The multiple sparks per firing cycle were deemed to be of great value in the successful firing of lean mixtures, but the inaccuracy in spark timing was a distinct disadvantage.

As a remedy, the number of flux gate stacks was reduced to the point where the maximum number of possible sparks was three. Of these, the middle spark was the greater due to the flux reversal at this point. Leading and trailing sparks occurred, one engine degree before and after the main spark, and so were well within the normal engine ignition timing tolerance.

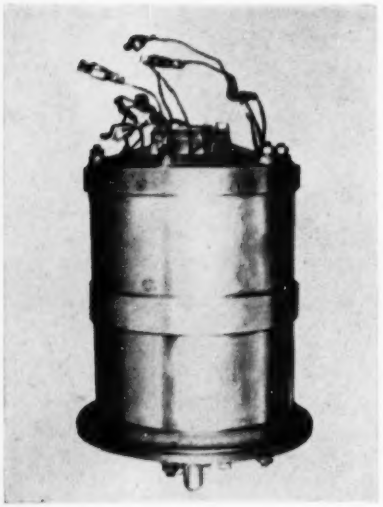
The generator is suitable for use with either single or dual-simultaneous ignition systems, the latter being made possible by the use of a twin secondary ignition transformer. Typical performance data is shown.

ABC Pulse Generator System with 100 mmf secondary load on transformer.

Generator rpm	Transformer Kilovolt Output (each of dual sparks)
25	14.0
38	18.0
50	26.0
100	29.0
150	29.0
200	29.0

Successful field tests of this unit proved that a practical ignition system having no breakers, commutators, slip rings, or brushes could be produced. The cost of the unit, however, was such as to cause great mental anguish both to ourselves and to our customers. The economics of the application gradually brought about an acceptance of the idea that breakers should be used for low-speed starting and removed from the circuit during normal running cycles.

This allowed a return to the basic



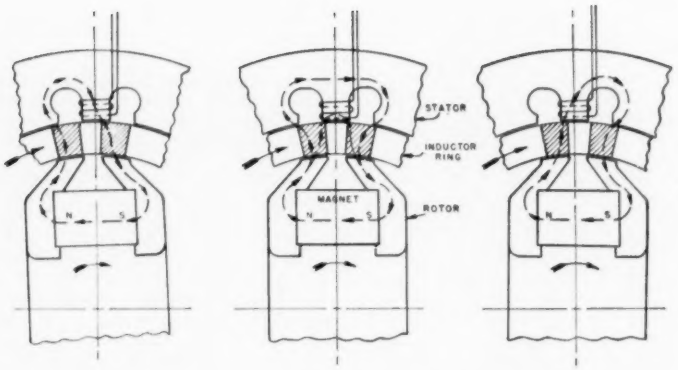


Fig. 6 **PULSE GENERATOR WITH "FLUX REVERSER"** to improve low-speed output. Action of the inductor rotor and flux paths shown in the section along with the characteristic output voltage wave.

simple low-tension pulse generator design with its great simplicity and service reliability. The starting cycle is controlled by a lever and the generator, with the starting mechanism end cover and terminal head removed, is shown in Fig. 7. The size shown is suitable for engines of 12 cylinders or less.

Other Systems

Whatever the preference of the engine builder, whether it be for high or low-tension distribution, self or battery-powered, a practical, high quality ignitioneered system is commercially available for the high compression engine.

Many spark ignited gas engines have been produced which utilize a battery-powered, low-tension distribution-type of ignition system. In one arrangement an individual breaker is used for each cylinder, and in another, a single breaker in combination with a low-tension distributing switch is used. Of the two, the individual breaker type is the more common and is generally designed with the breakers in a radial position about a central single-lobed cam. Ignition transformers may be fed in series to serve two or more simultaneously firing plugs per cylinder.

The battery-powered system was originally used because no magneto was then available which had a sufficiently high voltage output to reliably fire the high-compression gas engine. Its use has continued due to its advantage of easy servicing because of the fact that all of the components are of old and well-understood design, the unit being devoid of that aura of mystery commonly associated with magnetos.

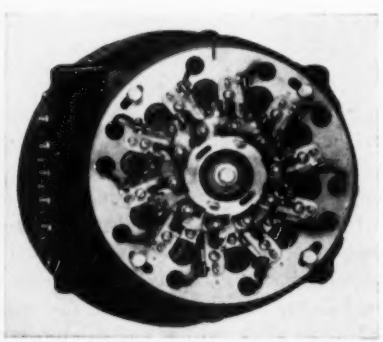
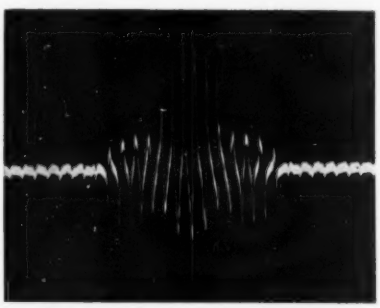


Fig. 7 **FINAL COMPROMISE PULSE GENERATOR** using breakers only to obtain high output while starting. End cover and terminal head have been removed to show breaker mechanism that is cut out of circuit after starting. This unit combined to the greatest degree functionalism and economics.

Summary

It may be said that an evaluation of the merits of the several systems described must include the following points:

Low-Tension Pulse Generator System—The advantages of this type of system are greatest for the operator who requires long trouble-free ignition service. The ignition timing, once set, is permanent since it is governed by



mechanical and not electrical considerations. Since there is no operating switching means in normal running, the wearing parts of the system are confined to the two bearings.

Battery-Powered System—The advantages of this system include high performance at very low starting speeds and ease of servicing by relatively inexperienced personnel. Its disadvantages are the requirement for an external power source, the multiplicity of contacts to be serviced, and the change in ignition timing during operation due to the normal contact or follower wear.

Low-Tension Magneto—The advantages of this unit are its small size and low cost. Its disadvantages are that impulse couplings or boosters are required for very low speed starting, and the breaker and low-tension distributor require periodic servicing. On some engines several magnetos must be used to perform the duty of a single radial timer or pulse generator.

Dieselized Farm Tractors

Today, we see more power being put in smaller packages. A good example of this is the recent installation of diesels in many small wheel-type tractors, where previously only the larger track-laying type tractors were diesel powered.

STOP look and listen is a phrase known to almost everyone, but how many do what the sign says? With future profits depending, to a large extent, on finding new ways to do work faster and at a lower cost, we had better take time out to look around and listen to some new methods.

Modern farm power is essential, as farms are constantly increasing in size. The American farmer, like any other businessman is, continuously looking for new methods by which to overcome high operating costs.

More efficient mechanization is one method of lowering operational costs. With diesels becoming more compact and power-to-weight ratios improving, many wheel type farm tractors are being manufactured with diesel rather than gasoline engines as the principal prime mover. Still more of these tractors are being converted to diesel by their owners and operators.

When taking a look at operating costs, it can readily be seen that fuel is the largest single operating expense. After converting to diesel, many operators report that fuel consumption and costs have nearly been cut in half.

In addition to cutting fuel bills, farmers say that plowing capacity has been greatly increased.

Reports from the Dakota area are shaping up as part of a national pattern with farm experience in Texas and the rest of the United States. More work for less operation cost featured the public demonstration of General Motors diesel power for the farm.

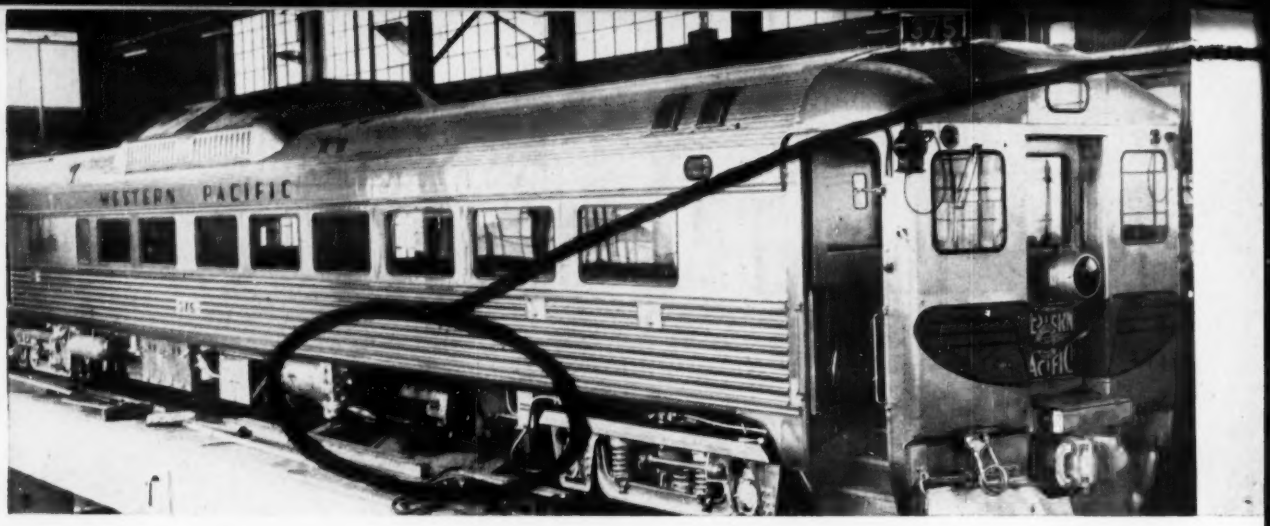
Farmers from the Dakotas and Minnesota converged on a North Dakota farm to see a diesel powered tractor plow 9.9 acres in three hours and 10 minutes, while using only 11.7 gal of fuel.

The run was made with a Case model LA tractor in which a General Motors model 3-71 diesel engine had been installed. A 5-bottom, 14-in plow, plowing 7½ in deep was used for the demonstration. When broken down, the figures showed that it averaged out to 3.7 gal of diesel fuel per hr or 1.18 gal per acre, at 17 cents per gal. The tractor operated at 5.45 mph, which was 3.17 acres per hour.

The North Dakota farmer, whose farm was the scene of the demonstration, told the group of more than 250 farmers about his 1942 Farmall model M tractor, in which he installed a GM 2-71 diesel last November. The unit is using 17 to 18 gal of diesel fuel per 12-hr day, at a cost of 17 cents per gal. With his previous engine, he used 30 to 35 gal of gasoline for the same period of time at a cost of 22 cents a gal.

A Texas Panhandle farmer claimed that a 2-cycle diesel installed in his 1928 model L Case tractor, had increased its work capacity by 50 per cent while cutting his fuel bills in half. These farmers made a point of the fact that there was less preventive maintenance required for the diesel.

Faster operation of a diesel tractor with additional horsepower and less time out for maintenance gives the farmer the chance to get the most done when time is at a premium.



Diesel Rail Car No. 375 is shown above with engine compartment encircled.

Rail Cars Success on

By Fred M. Burt

Two self-propelled diesel rail cars, model RDC-2, purchased from the Budd Company, are proving to be successful after only 18 months of operation. The two cars, Nos. 375 and 376, acquired at a cost of $130,000, were put into service on the 928-mile main line run between Oakland and Salt Lake City, in an attempt to recoup losses.

Use of these two cars has solved an extremely knotty problem of local passenger service. Two-thirds of the mileage covered is in Nevada and Utah, where population and related passenger service is sparse. The famous Vistadome California Zephyrs, introduced in March 1949, cover this area, but were designed mainly to attract the long-haul passenger. The problem of local service still remained.

Local trains were therefore established to perform the services that the Zephyrs, fixed and fast schedule made impossible. However, despite all efforts, the financial return on these local trains was very disappointing, resulting in a loss approaching a million dollars a year. With this loss to contend with, the overall passenger service operated well into the red.

Now, with the use of these new diesel cars, in place of the local trains, the Western Pacific passenger service on an overall basis is operating at a profit. This is the result of the large reduction in cost of providing the local train service.

Adapted for Comfort

Before being placed in service, the cars were sent to the Sacramento shops for mechanical and other improvements, in order to make the cars more adaptable to Western Pacific service. Electric water coolers were installed in the cars, as well as additional toilet and hot water facilities. The attractiveness of the cars' interiors was enhanced by the placement of photo murals.

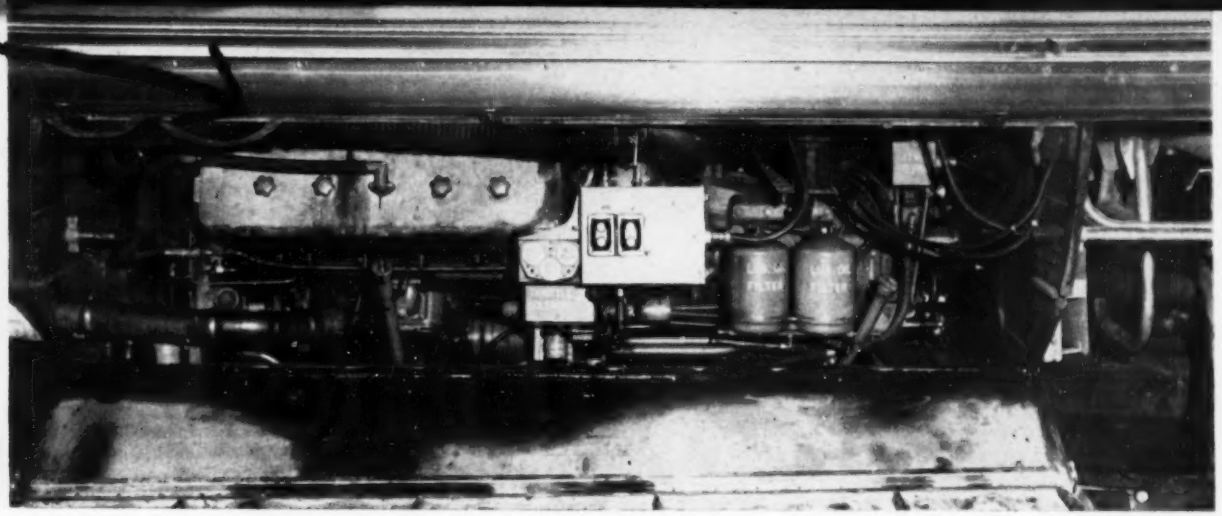
Back of the engineer's compartment, in the 85-ft, 112,000-lb stainless steel cars, are 16-ft compartments for express, baggage and freight, with special racks installed for convenience in handling shipments of iced fish. There is also a desk and hot plate for the use of the baggage man. Following that is a center compartment with reclining seats for 18 through passengers. The front and back stationary portions of these seats are equipped with footrests which may be folded upward and backward to an out-of-the-way position when not in use. In the main compartment there are seats for 48 passengers. At the rear, is a seat and collapsible desk for the conductor.

In the course of a year, the cars run through temperatures ranging from 20°-30° F below zero, to 110° F above. To regulate the temperature there are water pipes located in the car tops, carrying hot water from the rear engine's cooling system. Air is circulated around the pipes by fans for car heating.

This piping system, with thermostat control, is highly efficient for regulating engine temperature. When the water temperature rises above 176° F, the fans speed up for faster cooling of the water pipes, pulling in more air from outside vents. Car space-heating controls, maintain a proper interior temperature, with dissipation of excess heat to the outside. In hot weather, this outside heat dissipation and air circulating system provides comfortable air conditioning.

Diesel Engines

For power plants, each car has two General Motors (Detroit Diesel Division), 6-cyl. Model L-110, 275-hp,



It will be noted that the rear engines and other equipment beneath the cars is easily accessible from the sides.

Western Pacific

Diesel Rail Cars on the Western Pacific Railroad are putting passenger traffic operation on a profitable basis.

2-cycle diesel engines suspended from the car bodies on 20° angles. The engines transmit their power to the inner axles on each truck through an Allison Torque Converter, combining with the transmission as a single unit in one housing, and connected to the inner axles with Spicer drive gears.

Diesel fuel is carried in two 125-gal tanks which are filled at Oakland, Winnemucca (525 miles from Oakland) and at Salt Lake City. Fuel consumption averages about 2.8 miles per gal, a little over three cents fuel cost per mile. Engine lubricating changes are made after each third round trip (5568 miles). Each engine requires 56 qts of oil. After 30,000 miles of travel, the 72 qts of oil (Heavy Duty Special Lubricating 10-wt oil), used for the fluid drive in each Torque Converter, is replaced.

The cars are equipped with model CF Budd disc brakes, with thick discs that circle the brakes just inside the wheels. Brake shoes, made of a strong non-metallic material, bear against the sides of these discs. These brakes will last for more than 10,000 miles without change of linings, as against 4–6000 miles for standard shoe clasps. Brakes can be changed completely in a little short of a minute's time.

Maintenance Checks

In addition to the trip servicing at each end of the run at Oakland and Salt Lake City, all other maintenance, repair and overhaul work on the RD Cars is done in the RDC shop in the Oakland Yard.

At the end of 18 months' operation, (to Mar. 15, 1952), No. 375 had travelled 203,780 miles, and No. 376 a total of 203,510 miles. One complete engine change had been made on each car with conversion from aluminum to cast iron blocks and heads. At the end of the first 100,000 miles of servicing, engines were completely checked with the bearings being renewed and the cylinders honed.

Applied to these cars are the Daily, Weekly, Four-Weekly, Monthly, and Quarterly — Semi-Annual — Annual Maintenance Checks. After each trip, a "Locomotive Inspection Report" is made out. Practically all of this maintenance work is done by one man, James Thomas, an expert mechanic, working five days a week, with an extra man for the other two days. The engines, and other parts underneath the cars, are easily accessible.

Nicknamed *Zephyrettes*

Traffic-wise, the Budd car presents an attractive appearance. Its stainless steel construction makes it a fitting supplement to the California Zephyrs. For this reason, Western Pacific has dubbed the cars, *Zephyrettes*.

Zephyrette No. 2 leaves the Oakland station at 8:08 p.m. Sundays, Wednesdays and Fridays, and arrives at Salt Lake City at 7:45 p.m. the following days, Mondays, Thursdays and Saturdays. *Zephyrette* No. 1 leaves Salt Lake City at 8:30 a.m. Sundays, Wednesdays and Fridays, arriving at Oakland at 6:50 a.m. the next mornings.

There are 58 scheduled stops between Oakland and Salt Lake City. Thirty-five of these are flag stops and there are two, 30-minute meal stops each way: at Portola for breakfast eastbound and dinner westbound, and at Elko for lunch eastbound and westbound.

The addition of these two diesel car units to the Western Pacific's locomotives is another step towards the complete dieselization of the entire System. All scheduled passenger trains use diesel power, and freight service is about 85 per cent dieselized.

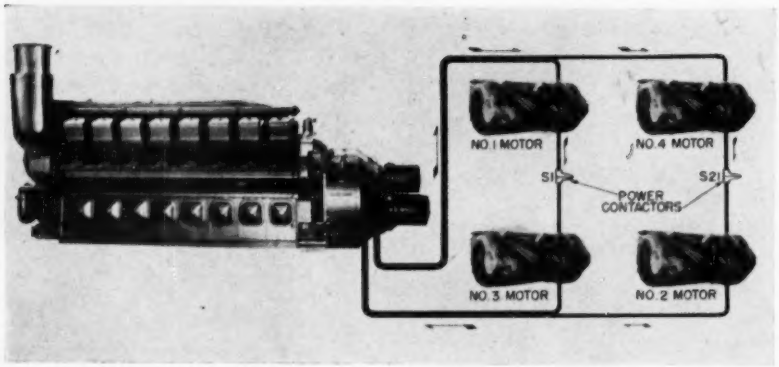
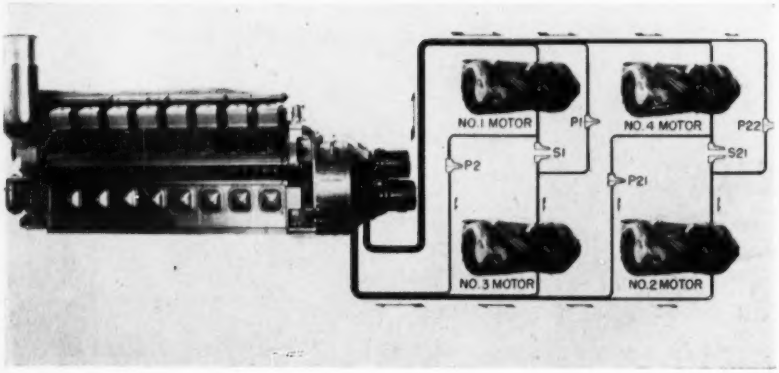


Figure 1 illustrates the locomotive electric system with the traction motors connected for low speed operation.

Figure 2 again shows the locomotive electric system, but with the traction motors connected for high speed operation. The arrows in both pictures indicate current flow.

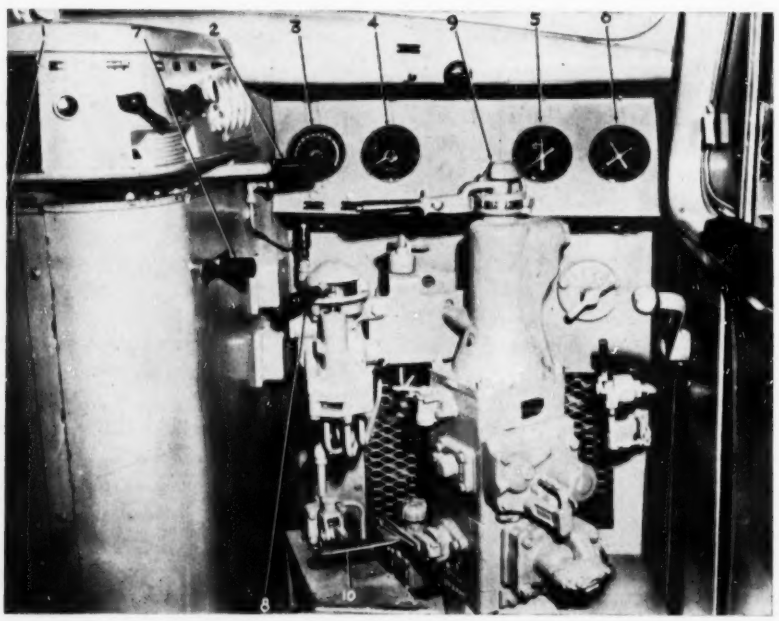


Second in a series of three articles, to better acquaint operating and maintenance personnel with diesel-electric fundamentals, has to do with control systems. Step-by-step descriptions help in understanding this complex subject.

Fundamentals of the Diesel-Electric Locomotive (Part II — Control Systems)

*by J. D. Alrich**

**Locomotive and Car Equipment Department General Electric Company, Erie, Pa.*



A typical control set-up at the engineers position on a diesel-electric road locomotive shown in figure 3.

1. *Selector handle*
2. *Throttle handle*
3. *Loadmeter*
4. *Speedmeter*
5. *Air gauge*
6. *Air gauge*
7. *Reverse handle*
8. *Locomotive air brake valve*
9. *Train air brake valve*
10. *Safety foot switch*

Figure 4 shows a control set-up at the engineers position on a two-engine switching locomotive:

1. *Locomotive air brake valve*
2. *Throttle handle*
3. *Load Indicators (one per generator)*
4. *Oil gauges (one per engine)*
5. *Water temperature gauges (one per engine)*
6. *Air gauge*
7. *Battery voltmeter*
8. *Engine start buttons (one per engine)*
9. *Selector handle*

You might compare the control system of a locomotive to the quarterback of a football squad. It organizes the individual parts into an efficient, smooth running "team" and directs their operation.

The first job of the control system is to connect the motors to the generator so that current will flow and start the train. This is done by closing the proper circuits. As the train speeds up, other circuits are closed—either automatically or by the engineman's control levers. In this way, the generator and motor connections are changed so that the voltage at the motors is increased. We call this changing of the motor circuits "transition." On many large road locomotives, it is made automatically. On other locomotives, it is made by operating a lever known as the "selector handle" or "transition lever."

Transition

As far as the results are concerned, transition on a diesel-electric locomotive may be roughly compared to shifting gears on your automobile. Of course, there are no gears to shift on a locomotive. Instead, as it speeds up, we change the traction motor circuits at the proper points to cause the locomotive to reach top speed with its train. If the train comes to a grade and slows down, the changes are made in reverse order—just as you shift your car to lower gear on a hill.

As an example, suppose that a road freight locomotive equipped with manual transition is starting a train. The engineer places the selector handle in position 1. Then he pulls the throttle lever out to the first notch. This closes the power contactors (S1 and S21 in Fig. 1) to connect the main generator and traction motors in what is called the "series-parallel" connection.

The arrows in Fig. 1 show the direction of flow and division of the current. We see that half the current from the generator flows through motors 1 and 3, and the other half through 2 and 4. With this arrangement, each traction motor has half the generator current flowing through it and uses half the generator voltage.

In the first notch, the motors develop enough torque to pull the slack out of the couplings and "stretch" the train. When this is done, the engineer rapidly moves the throttle notch by notch until the train starts. This movement speeds up the diesel engine and causes the main generator to develop more voltage. The higher voltage forces more current through the motors and increases their torque. Usually, the train will start at about the fifth or sixth notch.

If it is too heavy, the locomotive wheels will slip before it can be started. As the train begins to move, the engineer continues to notch up the throttle until the wide open position is reached. The diesel engine is now running at maximum speed and the train is accelerating under full power. This operation is like starting your car in low gear. It gives maximum pull, but does not permit high speed. For instance, the road freight locomotive in our example will bring its train up to only about 17-mph.

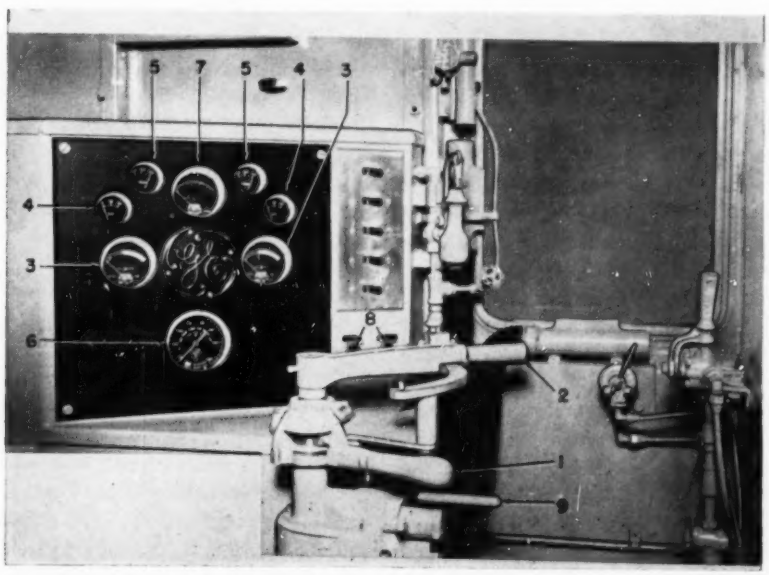
When this speed is reached, the engineer moves his selector handle to position 2, causing other switches (called "field-shunting contactors") to close. This has the effect of weakening the motor field current. As a result, the generator can force more current through the motors. The additional torque developed by the motors, speeds the train up to about 23-mph. This operation is like shifting your car into second gear.

At the proper speed, the engineer moves his selector handle to position 3. By this time, the need for high tractive effort has decreased. We now want to get higher speed. This can be done by raising the voltage on the traction motors.

When the engineer moves his selector handle to position 3, he rearranges the circuits to do this. We see from Fig. 2 how it happens. Power switches S1 and S21 are opened and P1, P2 and P21 and P22 are closed. With these new connections, each motor receives full generator voltage and one-fourth of the generator current. This arrangement of the circuits is called the "parallel" connection. It allows the locomotive to continue speeding up the train. This is like shifting your car into high gear.

In the parallel connection, our road freight locomotive will reach about 50-mph. At this speed, the engineer moves his selector handle to position 4. This closes the same field-shunting contactors that were used in position 2. The locomotive may then accelerate to its maximum speed of about 65-mph. This is like operating your car in overdrive.

If the train begins to climb a grade and its speed drops, the engineer will move his selector handle back to position 3 at 50-mph, to position 2 at



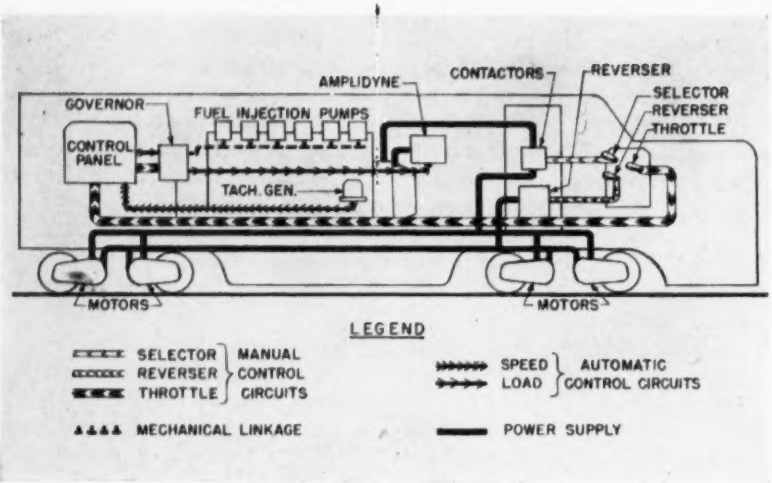
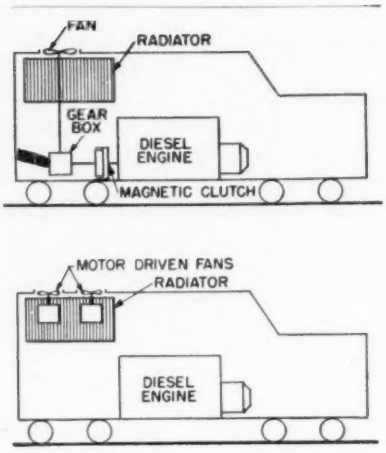


Figure 5 illustrates a diagram of the remote control system used on many large diesel-electric road locomotives.



Radiator fans driven by electric motors are shown in figure 6 (top) Figure 7 illustrates how fans are driven by the diesel engine through a magnetic clutch.

23-mph, and to position 1 at 17mph.

Locomotive control can be arranged so that all these changes are automatically made at the proper speeds. This is called automatic transition and is used on many road locomotives.

Switching locomotives do not use the four-step transition just described because they do not operate at high speed. They may use either one, two or three-step transition, depending on their size and service.

Locomotive Operating Controls

Controls necessary for operating the locomotive are located at the operating station in the engineer's cab. On road locomotives and most large switchers, this cab is at one end of the locomotive unit. Smaller switchers, using two diesel engines, have the engineer's cab in the center, between the two engines. Typical control stations are shown by Fig. 3 for a road locomotive, and by Fig. 4 for a switcher.

On every diesel-electric locomotive, we find a throttle lever, which is used to speed up or slow down the engine, and a reverse-lever which changes the direction of the locomotive motion. Except for these two levers, different locomotives have different types of operating equipment.

The controls on road locomotives and large switchers operate indirectly. By this we mean that they close contacts in low-voltage electric circuits. These circuits in turn, cause the locomotive control equipment to operate as desired. You can see a simplified diagram of such a system in Fig. 5. The remote control system is used because the size of these locomotives makes direct connection between the controls and the apparatus impractical. It also has the advantage that it permits two or more locomotive units to be operated by a single engineman.

With this system, the throttle handle varies the circuits which control the engine governor. When the throttle is notched up, the governor is regulated to supply more fuel to the engine. This speeds up the engine and causes more power to be delivered to the motors for accelerating the locomotive. Notching the throttle back has the opposite effect.

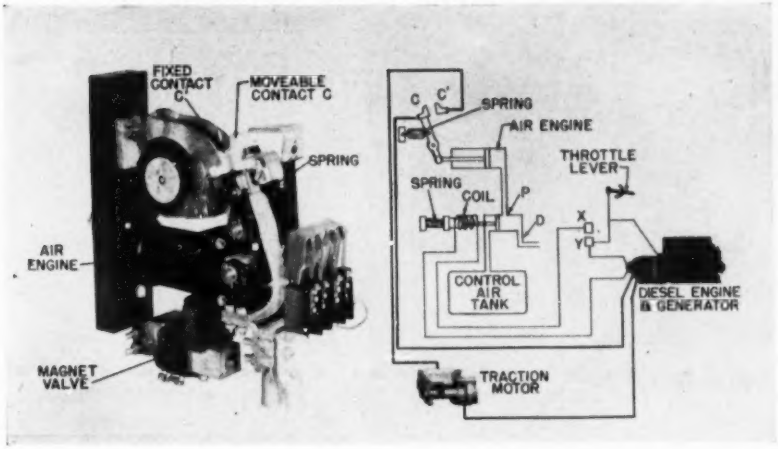
In order to reverse a locomotive, we have only to reverse the direction of rotation of the traction motors. We can do this by reversing the direction of current flow in the motor fields. The engineer's controls include a "reverse" handle for this purpose. It has three positions: "off", "forward" and "reverse". When he moves this handle, it closes control circuits which cause the reversing switch to turn to the proper position. This switch fixes the direction of current flow in the traction motor fields.

When the engineer has his handle in the "forward" position, current flows so as to turn the motors in the direction to move the locomotive ahead. When it is in the "reverse" position, the switch is moved so as to reverse the direction of this current. This causes the motors to turn in the opposite direction and move the locomotive backward.

On most locomotives, the three control handles are so interlocked that the engineman cannot move them at the wrong time. For instance, it would damage the traction motors to reverse them when the locomotive is moving forward. The reverse handle, therefore, is so connected with the throttle handle that the throttle must be placed in the "idle" position before the reverse handle can be moved. This makes certain that power is removed from the motors before they are reversed.

Road locomotives also have a safety foot-switch, as shown in Fig. 3. The engineer must keep his foot on the pedal whenever the locomotive is moving. If he releases the pedal, power will be automatically cut off from the traction motors and the air brakes applied to bring the train safely to a stop.

Other controls at the engineer's position operate the headlight, the warning signals, the sander valves, various cab and instrument lights, the window



In figure 8 an air operated contactor is shown both as a unit and schematically.

wipers and defrosters, the cab heaters, and the emergency stop controls. Lights, working together with alarm bells and buzzers, warn the crew of such troubles as slipping wheels, overheated engine, low lubricating oil pressure, and (on passenger locomotives) trouble with the train-heating equipment.

In front of the engineer is an instrument panel similar to an automobile dashboard. It usually contains four instruments: a loadmeter, a speedmeter, and two air gauges. The loadmeter measures the current flowing through the traction motors. It tells the engineer whether or not the motors are operating within safe heating limits.

If the train is too heavy or the grade is too steep, the motors will draw very high currents from the generator, which may result in damage by overheating. The loadmeter shows the engineer that he must not continue to operate the locomotive beyond the time limit indicated without reducing the load to a safe value.

The speedmeter tells the engineer how fast his train is going. On locomotives equipped with manual transition, it serves another purpose also. As the needle crosses the lines located below the scale on the dial, the engineer moves his selector handle to the same position as the number indicated by the pointer. This assures that the different transitions are made at the proper speeds.

Construction of traction motors is such that they may be overloaded for a short time. The loadmeter, therefore, usually has a "short time operating zone" marked on its face. Some meters have this zone labeled to show how long the motors can operate at the indicated load without damage.

Let us suppose, for instance, that a locomotive is hauling its maximum rated tonnage on level track. If it comes to a grade, it will start to slow down. This will cause the traction motor current to increase and the loadmeter needle will move toward the "short time zone". If the speed drops low enough, the engineer will have to reduce the current by moving the transition lever backward. If, with the motors in series, the needle moves into this zone, it warns the engineer that the motors are overloaded and beginning to heat up. He may, however, continue to operate the locomotive under this condition for the length of time shown on the loadmeter.

If the train tops the grade and picks up speed enough to bring the needle out of the "short time zone" before the limit is reached, no harm will be done. By taking advantage of this feature, the engineer may continue to move his train, although at time the motors are overloaded.

Air gauges show pressures in various parts of the air brake system. The engineer watches them as he operates the brake valves. They show him how strongly the brakes have been applied, and how much pressure there is in the air storage reservoirs and train line.

Cooling Water Control

Some locomotives have electrically-driven radiator fans as shown in Fig. 6. We can control the amount of radiator cooling on such a locomotive by varying the speed of the fan motors. This is done by changing the electric connections of the fan motors. The control may be automatic by a thermostat, or manual by hand-operated switches.

Another widely-used system of radiator fan drive makes use of a magnetic clutch, one part of which is driven by the engine. The other part of the clutch is connected to the radiator fan through a gear box as shown in Fig. 7.

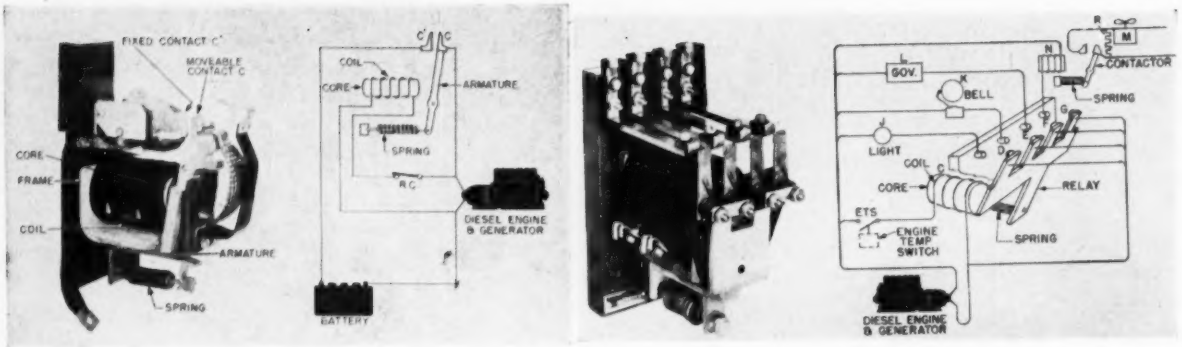
The two parts have no mechanical connection, but make use of the magnetic "drag" principle. In operation, one-half of the clutch is magnetized by current from the auxiliary generator. This causes it to tend to "stick" to the other half by magnetic attraction. This "sticking" or "drag" rotates the fan shaft. Fan speed is controlled by varying the current in the clutch. The stronger the current, the more the drag and the faster the fan will run.

On switchers, the radiator fan is belt-driven from the engine in much the same manner as on your car.

Auxiliary Generator

The control system, our locomotive quarterback, operates from the auxiliary electric power supply. This is a small DC generator which is driven from the main generator shaft. It may be geared, belted, or direct-connected to the shaft. We usually call it the "auxiliary generator". It supplies power, at 75 volts in most cases, which is used for many purposes, including the operation of:

1. Small motors for the fuel pump,



An electromagnetic contactor and how it works is shown in figure 9. Figure 10 illustrates a relay and how it is used to do several jobs at once.

the cab heaters, the defrosters, etc.

2. Power contactors, control relays and the reverser.

3. Radiator fan motors, or the magnetic clutch which drives the fan.

4. The locomotive automatic alarm system.

5. The locomotive safety equipment and protective devices.

6. The diesel engine starting equipment.

7. Locomotive lights, and charging the storage battery.

Power Contactors

We have mentioned power contactors before. They are the large, remotely-controlled switches which open and close the circuits between the main generator and the traction motors. They are operated either by air (electro-pneumatic), or by electricity (electro-magnetic).

Fig. 8 pictures an electro-pneumatic contactor and shows how it operates. The protective cover, or "arc chute" has been removed to show the contact tips. When the engineer advances his throttle lever from the "idle" position, contacts X and Y close. Current from the auxiliary generator then passes through the coil of the magnet valve.

This magnetizes the plunger and pulls it into the coil far enough to open the port P. Air from the control reservoir rushes into the air-engine cylinder. As the piston moves under this air pressure, it closes the contact tips C and C'. This allows current to flow from the generators to the motors.

When the engineer returns the throttle to the "idle" position, contacts X and Y are opened. This cuts off current from the coil of the magnet valve and allows the spring to push the plunger back. The air escapes from the air-engine cylinder through the port D. As the pressure drops, the spring in the contactor separates contacts C and C', thus cutting off the flow of current to the traction motors.

A contactor may have one or more "interlocks" mounted on it (See Fig. 8). As the contactor operates, these interlocks open or close control circuits of other apparatus. This serves to guard against faulty operation of the locomotive control.

Fig. 9 shows an electro-magnetic contactor (also without the arc chute) and how it operates in the battery-charging circuit. When the battery requires charging, the reverse current relay contact RC closes, sending current through the contactor operating coil. This magnetizes the iron core and pulls the armature up to close contacts C and C'. Current then flows from the auxiliary generator to charge the battery.

Relays

Relays are small, but important pieces of control equipment widely used on locomotives. A relay operates in the same way as an electro-magnetic contactor, but is much smaller because it does not have to handle heavy currents.

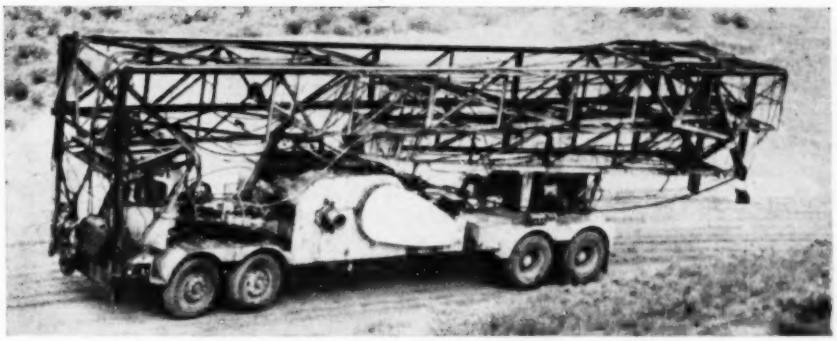
One type of relay and the circuits which it controls are shown in Fig. 10. This relay warns the engineer of overheating in the diesel engine and automatically protects its against damage. If the engine becomes too hot, temperature switch, ETS, closes. This allows current to flow through the relay coil C which magnetizes the core B, which pulls the contacts shut. Contact D lights the light J at the operating station. Contact E rings the bell K. These both act as warnings to the engine crew.

At the same time, contact F operates the engine governor L to reduce the engine speed to idling and prevent further overheating. Contact G operates contactor N to short-circuit the resistance R and operate the radiator fan motor M at high speed to provide additional cooling. Here we see how one small relay does four jobs to call attention to the hot engine and also protect it from damage.

Battery

Diesel-electric locomotives are equipped with batteries like those in our automobiles, only of much greater size and capacity. Their important job is to start the diesel engines. Many locomotives have a starting button in the cab similar to the starter button on the dashboards of some cars. When it is pushed it closes contactors which allow current from the battery to flow through the main generator.

The generator then operates as a motor and cranks the diesel engine. As soon as the engine fires, the starting button is released, disconnecting the battery from the generator. The auxiliary generator then recharges the battery in preparation for the next start.



With the 90 ft. derrick folded to a ready-for-the-road position, the rig's overall length is under 50 ft.

Unit partially erected at well site. A single 6-cyl. diesel powers the entire rig.

"Hoistmobile"—Oil Well Servicing Hoist

This self-propelled rig services wells, both rods and tubing, down to 6500 feet.

A NEW oil well servicing hoist recently developed by the Hopper Machine Works of Bakersfield, California is so flexible in its operation that it can be moved from job to job under its own power and easily maneuvered into position at the well.

One of the first of these units manufactured was put to work by the Richfield Oil Corporation of Los Angeles, California. Its first assignment was in the Cuyama Valley. Curving roads, grades up to 20 per cent, rough terrain and hard-to-reach small well locations seemed to offer little hindrance to this vehicle.

On location, the operator can drive into position at the well without complicated backing and, with excellent visibility from the cab, see where he is going at all times. This, of course, is an important advantage from a safety and time saving angle.

Basically, the Hoistmobile is a four-axle vehicle, 35 feet in length, with the engine mounted at the extreme rear, a double drum winch amidships, and a folding derrick at the front over the cab.

The chassis consists of two main full length longitudinal members, fabricated of alloy steel with suitable cross members. It is of the "double drop" type which provides maximum stability with the required wheel clearances. In addition, the chassis members serve as the engine base, the hoist base and as an integral part of the derrick base.

Rear-end assembly is a standard tandem axle and differential unit equipped with dual wheels. Front-end assembly is also a pair of tandem axles, equipped with single wheels, but with both pairs of wheels steerable. This feature greatly increases the maneuverability of the vehicle by reducing the turning radius, and eliminates tire damage by scuffing, which usually results from the use of tandem front axles with only the front pair of wheels being steered.

Power for both propulsion and hoisting is furnished by a single engine. Standard equipment calls for a GM 6-71 engine although other engines can be furnished at the customer's option. The engine is mounted at the extreme rear of the vehicle with the radiator facing aft, and the torque converter output shaft forward. Immediately ahead of the converter output shaft, and coupled to it by a short universal joint shaft, is a right angle gear box, with a straight-through shaft as well as one at 90° from the input.

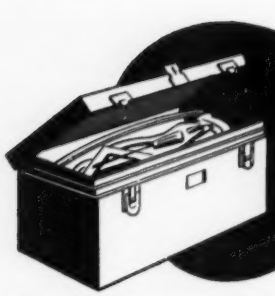
The straight-through shaft of the right angle gear box is coupled to the input of a Model TG 607 Allison Torqmatic Transmission, which in turn drives back and down to the differential through another universal joint shaft. The TG 607 transmission, which is hydraulically actuated and full-torque shifting, has three speeds forward, a neutral, a reverse and an overdrive feature.

The 90° shaft of the right-angle gear is coupled to the input of a Model TG 602 Allison Transmission, which in turn drives the hoist by means of a roller chain. The TG 602 transmission is similar to the Model TG 607, except with respect to the shaft arrangement. Since only two speeds to the hoist are needed, the 1st speed ratio is left out of the TG 602.

One of the outstanding features of the Hoistmobile is the Hopper folding derrick. With a clear working height of 90 feet and a hook load rating of 70-tons, it folds into road position with an overall length of only 49 feet, 6 inches and a maximum height of 13 feet, 6 inches. Blocks remain strung at all times, thus speeding the operation of moving from one location to

Controls located in the one-man cab of the vehicle are astonishingly simple for a unit of this size. Two outstanding features are elimination of the clutch pedal, and reduction of steering effort by a hydraulic booster.

Certain features of the Hoistmobile such as the folding derrick and the tandem front axle assembly with all wheels steerable were originated by the Hopper Machine Works and are, therefore, understood to be currently exclusive to their manufacture.



Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

GM Water Pump Coupling Modification

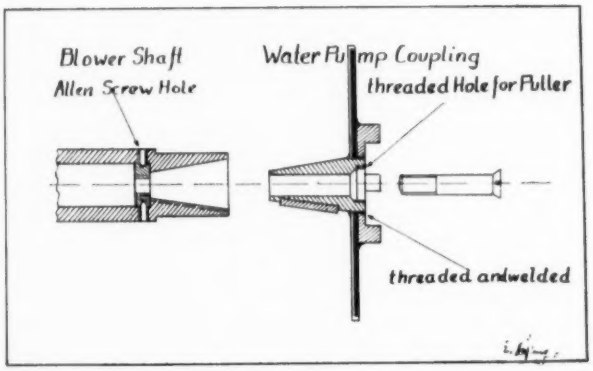
EPHRAIM NEIDING, UPPER GALILLEA, ISRAEL—We own several GM Series 71 engines, among them 6-cyl engine-generator sets. A short time after their installation and run-in, we noticed pronounced wear in the splining of the blower shaft and the water pump intermediate shaft coupling. We built and installed a new unit. After a short time we had the same trouble.

In Israel, the difficulty in getting spare parts is ever present. It is usually easier to make replacements whenever it is at all possible. So, with apologies to General Motors, we radically changed the coupling design.

We lathe-turned a new blower shaft replacing the splines with an internal taper. Inside the hollow shaft and butting on the small end of the taper, we placed a washer with a threaded hole. It was held by two Allen screws.

A new intermediate coupling was made using a male taper instead of the splines. Keyways were cut in both the male and female tapers. To insure rigidity and strength, we bored and counterbored so that a screw could be installed to hold the coupling to the shaft by threading into the washer. To facilitate removal, we threaded the head of the coupling to fit a standard GM puller.

In this work, we did not change any of the basic dimensions in the entire assembly. The installation has worked to our complete satisfaction for 5000 hours and we hope and expect it to continue indefinitely.



(Nice piece of work, and a lesson in what can be done when parts are not available. The last war was a great teacher in that respect. This is the first hearing of trouble encountered with the splines so common to GM (Detroit Diesel) engines. We found them convenient and generally excellent. We suggest that original failure was caused by omitting or failing to tighten the expander screw or by misalignment. Pump connections can cramp the pump if alignment is not watched. Incidentally, Mr. Neiding thinks so much of DIESEL POWER AND DIESEL TRANSPORTATION, *that he wants his $10 applied to extension of his subscription. Amen.—Editor)*

Pressure Testing Expedient

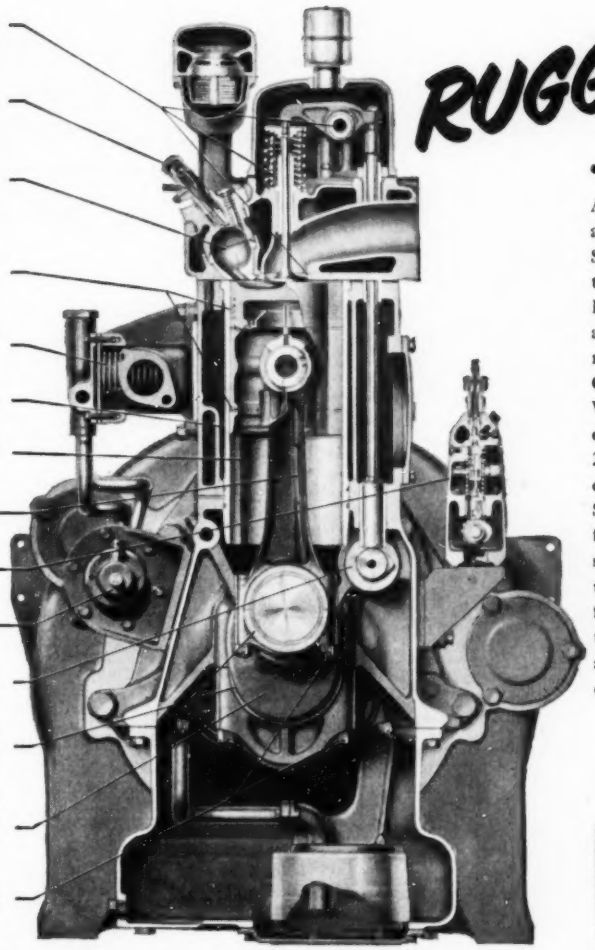
WALTER K. HYRE, SEATTLE, WASH.—It is often necessary to pressure test radiators, tanks, cylinder heads, etc., in the field or in shops where the necessary gauges and testing equipment are not available. If there is an acetylene welding rig around, and there usually is, here is a quick and positive test.

Plug all of the openings except one: say for a radiator, the filler hole. Fill with water or diesel fuel. Wrap the tip of an acetylene torch with tape, rubber, if available. Next, set the pressure diaphragm to the desired pressure. Force the wrapped tip tightly into the hole, turn on the oxygen, and watch for leaks.

Since the vessel is filled with liquid, there will be little oxygen used, but its pressure, as determined by the regulator, will be exerted on the liquid.

Here is another good stunt for drilling hardened steel. By using a carbon steel drill (most numbered or lettered drills are carbon steel), with carbon tetrachloride as a coolant, metals as hard as a file or a bearing race may be drilled. Turn the drill as slowly as possible, 100 rpm or less. It is often necessary to touch the spot to be drilled on the emery wheel.

(Mr. Hyre, who functions as Port Engineer for an Alaskan salmon cannery in the summer, has developed a lot of good ideas. There will be more later.—Editor)

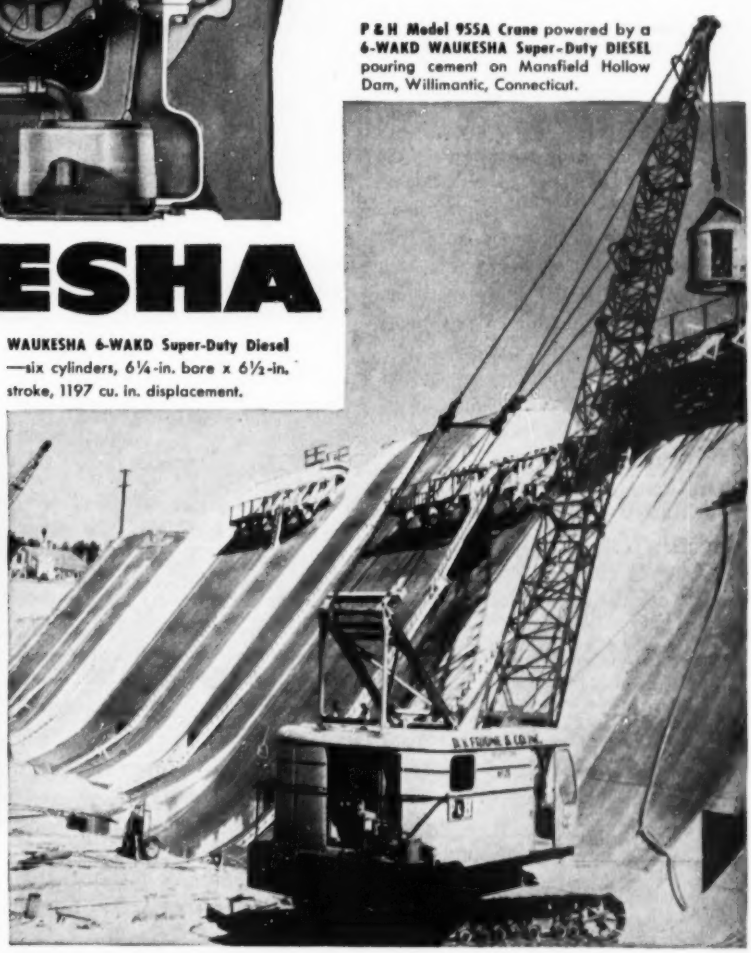

Dual springs, long guides. Pressure-oiled rockers. Stellite-faced valves and seats.
American Bosch single-hole pintle nozzles.
Clean-burning combustion chamber removes from outside. Upper half water cooled; lower half air insulated to concentrate heat at throat.
Four non-stick "keystone" rings, top ring chrome-plated. Two flat oil rings.
Built-in oil cooler increases oil and engine life.
Full length water jackets.
Hardened renewable cylinder sleeves test 375-425 Brinell.
Rifle-drilled rods. Oil jets cool pistons.
American Bosch fuel injection pump.
High-capacity outside oil pump.
Hardened camshaft, single forging.
Hardened main and rod journals. Steel-back, triple-element precision bearings, pressure oiled.
Drop-forged hardened crankshaft. High-speed counterweights not shown.
Alloy-steel heat-treated rod and main bearing bolts.

RUGGED POWER

...Slick and Smooth!

Almost the same second the crane operator puts on the power the Waukesha Super-Duty Diesel snaps right into it. It's that *fast recovery* that makes a Waukesha Diesel so different! Shovel and crane operators, contractor-owners, and machinery-makers agree on that. ● Harnischfeger Corp., Milwaukee, Wis., uses the 6-WAKD Waukesha Super-Duty Diesel as standard equipment on their P & H Model 955-A 2½ to 3 cu. yd. shovels, draglines and cranes. ● Like all Waukesha Diesels, this Super-Duty Six has many exclusive design features. Most outstanding is the patented spherical combustion chamber. That's the *why* of Waukesha Diesels' unusual performance—the lively responsive acceleration, smooth, shock-free operation, clean and complete combustion with high fuel economy and low maintenance.

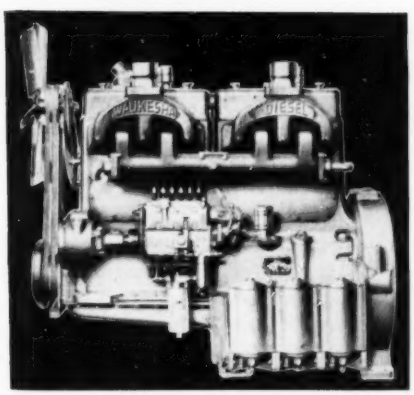
P & H Model 955A Crane powered by a **6-WAKD WAUKESHA Super-Duty DIESEL** pouring cement on Mansfield Hollow Dam, Willimantic, Connecticut.



WAUKESHA 6-WAKD Super-Duty Diesel —six cylinders, 6¼-in. bore x 6½-in. stroke, 1197 cu. in. displacement.

WAUKESHA Diesel

185



Send for Bulletin 1415

WAUKESHA MOTOR COMPANY
WAUKESHA, WISCONSIN
NEW YORK • TULSA • LOS ANGELES

New Products

Lighter Truck — More Payload

The trend toward lighter but more powerful trucks for highway and off-highway haulers went sharply forward recently with the announcement of new medium and heavy-duty truck models by the GMC truck and coach division.

Three of the new diesels were six-wheelers, to meet the growing demand for this type of unit by highway haulers. The fourth diesel model was introduced to answer the need for lightweight, low cost diesel power in the 21,000-lb gvw to 45,000-lb gcw range.

Weight reduction in one of the new model series averaged as much as 865 lb lighter than the former models. This means extra payload and lower ton-mile costs for the operator.

Other new developments in the models were: shortening of all heavy-duty models from bumper to rear of cab to allow use of longer trailers in 45-ft length limit states; new lightweight, load-cushion springs with fewer but thicker leaves; electric shift introduced as standard equipment on all trucks from the 450 model up.

New Heavy Duty Torch

Industrial Engineered Products Company, 7416 Melrose Avenue, Los Angeles 46, California, introduces its new heavy duty "Bazooka" torch. The torch features a self-cooled adjustable pistol grip handle that may be easily moved close to the burner for better control or back away from the reflected heat of the work. Its weight 2½ lb., complete with hose assembly, and produces a flame range from a soft, lapping flame of 5 in. long and 1-in. diameter to a large hard blast flame of 20 in. long and 5-in. diameter.

The torch was designed especially for the industrial field and is operated from standard liquid petroleum gas (butane-propane) cylinders at tank pressure with no gas regulator required.

Whirlpool Cleaning Units

Strong whirlpool-like agitation of cold cleaning solvents loosens and removes dirt, oil, grease and chips from parts placed in the new "wirl agitor" cleaning units, according to the manufacturer, Graymills Corporation, 3705 Lincoln Avenue, Chicago 13, Illinois.

Parts are placed inside the heavy gauge steel tank, in a basket or steel rack. The solvent is swirled in a vortex, cleaning them automatically. An electric motor drives the V-belt and the impeller. Grease-sealed dual ball bearings keep the impeller correctly aligned. Only the impeller and the seal are mounted in the tank, while the ball bearings are located below the tank bottom, sealed off from any solvent.

For convenience, the basket can be hooked onto the side of the tank to permit draining solvents off the parts. Eight model numbers are listed ranging from portable units with casters up to compact stationary types capable of handling several sizes of engine blocks. They range in capacity from 5 to 330 gallons. All are equipped with motors. Pump unit is optional.

New Universal & Single Range Hand Tachometers

O. Zernickow Company, 15 Park Row, New York 17, N. Y., announces their two new tachometers, the universal and the single range. Both these instruments have a knife-edge hand that makes almost two complete turns for each range. This results in a very long scale with wide open divisions which are easy to read at all points.

A cross pendulum operates on the centrifugal governor principle, with fully balanced construction for reading in any position, immuntiy against changes in temperature, electricity, magnetism or moisture. It is also claimed that they are not affected by rapid acceleration or normal overspeeding.

The universal hand tachometer has a 3-in. dial, single spindle, triple selective range with rotating gear shift. It is made in two different range combinations for speeds 25-30,000 rpm. and 30-40,000 rpm., respectively. Fpm. speeds are half of the above, using a 6-in. circ. cutmeter wheel supplied.

Single range hand tachometers have a 3-in. dial, and a range of 300-4000 rpm., 150-200 fpm. using 6 in. circ.

cutmeter wheel supplied. This type is suited for production work where certain speeds are encountered very often, for instance, for testing of motors, generators, turbines, as well as for control and maintenance work.

Dye Penetrant Inspection

Development of a new, high-speed dye penetrant inspection process, formulated to serve those industries in which production-line inspection is desired, was announced recently by Turco Products, Inc., 832 E. 62 St., Los Angeles 1, Calif.

Non-flammable "chek-spek", when used in conjunction with a vapor degreaser, requires only two materials—penetrant (flash point 140° F) and developer (flash point 130° F).

Following pre-cleaning by vapor degreaser, the red penetrant is applied to those parts being inspected. After being allowed to dwell sufficiently long for it to enter even the smallest defect that extends to the surface, the surface dye is removed by suspending the parts for a few seconds in the vapor zone of a vapor degreaser.

Following dye removal the white developer is sprayed onto the parts being inspected. Strong developer capillary attraction pulls out the dye which has remained trapped in existing flaws. As the white developer dries, the red dye bleeds into it, clearly locating and defining the extent of flaws.

Aluminum Tube Fittings

In response to the demand arising from the growing use of aluminum tubing for industrial fluid-handling systems, the Parker Appliance Company, 17325 Euclid Ave., Cleveland, Ohio, announces production of a standard-stock line of aluminum tube fittings for strictly industrial applications rather than aircraft use.

The line includes male and female connectors, elbows, tees, union and tube end reducer for ¼, 5/16, ⅜ and ½-in. outside tubing.

This new line of aluminum fittings is provided in the same Triple-lok design—the 3-piece flare fitting famous for its sleeve—which, in brass, steel and stainless steel, is accepted as the tube fitting standard in a wide variety of industrial equipment and processing installations.

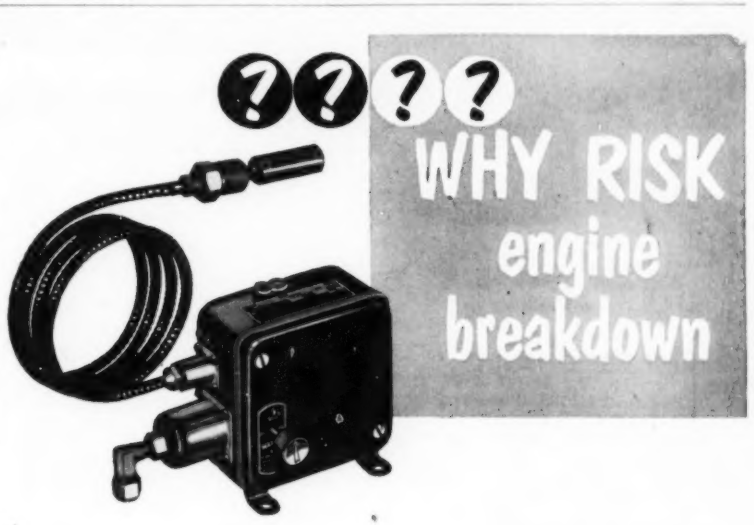
Rubber and Glass Sheeting

Rubber & Plastics Compound Company, Inc., 30 Rockefeller Plaza, New York 20, N. Y., has added a new product, "Nerva-Clad" to its line of waterproofing and corrosion protective materials. It is a truly engineered membrane built around a woven spun glass ply, ready for installation in one operation, and is designed for waterproofing and corrosion protection of structural steel reinforced concrete, tanks, tunnels, pipe lines, etc.

The components parts of the product, namely, spun glass, synthetic rubbers and asphaltic hydrocarbons are said to be strongly resistant to moisture, oxidation, corrosion and climatic changes.

Diesel Mine Locomotive

One of the newest diesel locomotives developed is for use in underground mines. Driven by a 6-cyl. Hercules diesel engine, the locomotive developed by the National Mine Service



Here's a low-cost safety control that prevents little troubles in engine lubricating and cooling systems from *growing into major breakdowns.* Remember . . . these minor troubles can develop even in the best engines. So, don't take this needless risk . . . protect *your* engines with PENN Safety Controls.

Learn more about this low-cost protection for *new and old engines.* Three basic models are available for oil pressure, water temperature, and combination pressure and temperature. Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ont.

Typical Functions of PENN Safety Controls

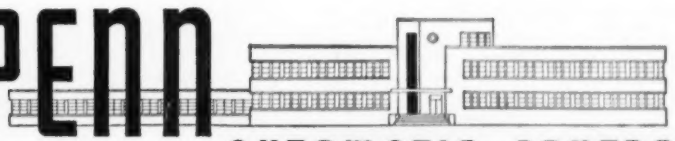
Diesel Applications. Sounds an alarm . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

Battery Ignition Applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications. Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds alarm or lights signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.

PENN

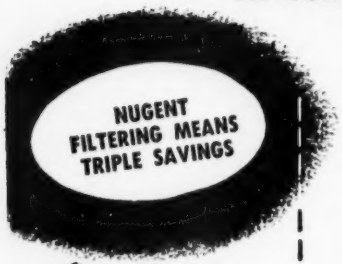


AUTOMATIC CONTROLS

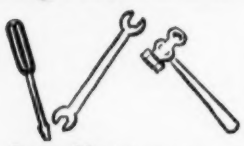
FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

Nugent "Full Flow" installed on 83 KVG Ingersoll-Rand compressor at Mulata Crude Stabilization and Pressure Maintenance Plant of the Creole Petroleum Corporation, Venezuela.
NUGENT
CREOLE PET
I-R 1949

DON'T OVERLOOK THIS CRUCIAL POINT IN COMPRESSOR OPERATION



Longer Machine Life



Less Maintenance

Less Oil Replacement

IT'S the lube oil filtering system, and it can play a big part in your profit and loss statement.

If you put a Nugent "Full Flow" filter in that spot you can be sure of stopping 99.8% of the harmful impurities that get into lubricating oil before they reach the vital working parts of the compressor. This is the kind of filtering that pays for itself many times over in oil savings, increased equipment life and reduced maintenance.

In Nugent "Full Flow Filtering" all the oil being circulated through your equipment is filtered every cycle. No part of the contaminated oil bypasses the filter. Dirt that is removed from the oil collects inside the special Nugent filter bags. When these bags fill up they can easily be cleaned and reused or new replacement bags are inexpensive. In addition, Nugent filter bags have 20 times more filtering capacity than others of comparable size.

Whatever type of machinery you use — compressors, gas engines or diesels — Nugent Filters can answer your filtering problems. There is a size and type for every need. Write for complete details.

Wm. W. Nugent & Co., Inc.
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Company is the first approved by the U. S. Bureau of Mines.

Power is applied smoothly through the Twin Disc hydraulic torque converter, which automatically matches torque output to load. Fine control permits operation up to the slipping point, and when sanding is required it does not interrupt power flow. Further advantage cited by the manufacturer for diesel operation is elimination of power stations, feeder lines, trolley wire, poles, etc.

Three New Tractors Introduced By Mack

Mack Motor Truck Corporation has produced three new tractor models to carry bigger payloads and still stay within legal limits. Ratings on these new tractors range from 45,000 to 58,000 lb. gcw. The engines have many features designed to give low fuel consumption.

A new feature in the diesel engine model is an ether-injection starting system, confined under the hood and controlled from the cab.

New Dead Center Lubricant

Molykote-Centerlube, a new lubricant for dead center lubrication wherever loads and speeds are beyond the capacity and temperature ranges of conventional center lubricants, has been announced by The Alpha Corporation, 179 Hamilton Avenue, Greenwich, Conn.

The basic ingredient is Molykote type Z, a lubricating grade of molybdenum disulfide powder which will bond a lubricating film on bearing surfaces and impart the low friction and anti-seizing properties necessary to resist extreme bearing pressures and temperatures.

The lubricant has also been successful for steady rest lubrication and for reducing wear on plug and thread gauges. It can also be used for press fitting, heavily loaded gears, ways and gibs of machine tools, etc.

Precision Drilling Machines

Announcement is made by The Hamilton Tool Company, Hamilton, Ohio that super-sensitive, small hole, precision drilling machines are now

available in single base, multiple spindle design.

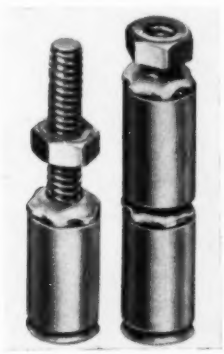
These machines have capacities of 0.004-in. to 5/16-in. hole diameter, clearances up to 8 in. from center of chuck to column, and up to 14 in. from base to chuck.

Adjustable stops are provided on all machines for the precision control of hole depth, and one model features spindle speeds, variable between 840 rpm. and 9300 rpm., controlled by a graduated hand wheel speed dial.

The machines are offered in single base, multiple spindle design in response to the growing demand for high production in precision drilling. The accurate machining of the continuous base pads make the use of box fixtures feasible, thus increasing production materially with no loss in precision. Stands are also available in appropriate lengths as shown.

New Anchor Bolt Assemblies

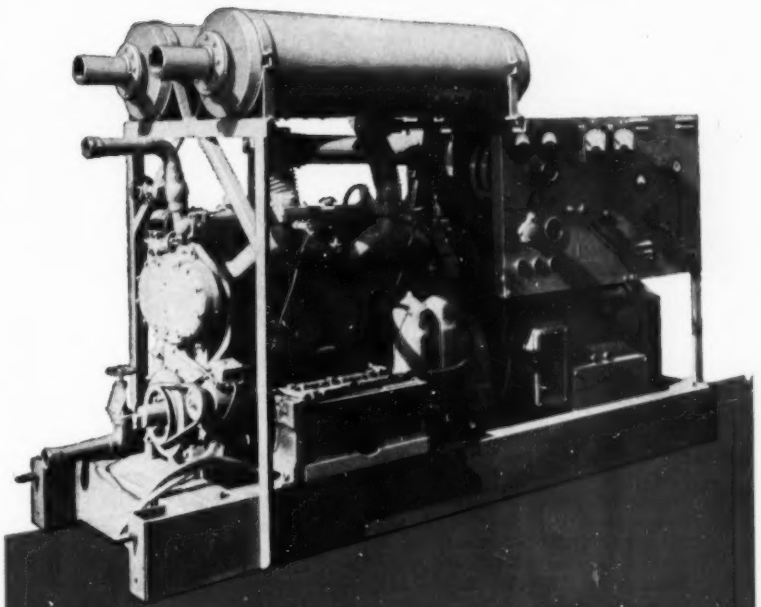
Super-Grip Anchor Bolt Co., Inc., 3333 North 22nd Street, Philadelphia, has developed new single and double anchor bolt assemblies. The company guarantees them to give 50 per cent greater anchorage wherever anchor or expansion bolts are used.



After insertion of anchor bolt, lead sleeve and cup-shaped steel anchor, a tamping tool mushrooms the lead first. Repeated blows flatten out the anchor, driving its ribbed steel edges into the walls of the hole. The steel reinforces the lead and provides a solid anchorage, preventing bolts from loosening.

The anchor can be put in masonry, brick, wood, etc., at any angle and the bolt can then be bent or off-set without disturbing the anchorage. Single

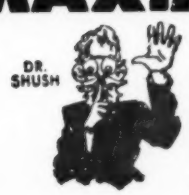
MAXIM SILENCERS*



GOOD PUBLIC RELATIONS FOR PORTABLE POWER ANYWHERE

* Two Maxim Exhaust Silencers shown on General Motors Diesel generator set built for portable power for "on location" movie making.

Consult MAXIM



THE MAXIM SILENCER COMPANY
93 Homestead Ave., Hartford 1, Conn. Dept. W.L.

Gentlemen:
Please send me your bulletin on Exhaust Silencer.

Name _____
Company _____
Address _____
_____

Pumps

FOR

MANUFACTURING

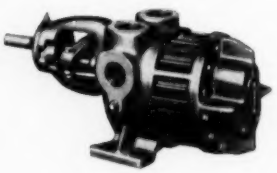
PETROLEUM, MARINE AND PROCESS INDUSTRIES

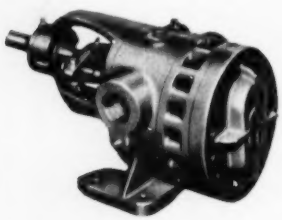
MODELS FROM 3/4 TO 300 G.P.M. — CAPACITIES TO 1000 P.S.I.

SPEEDS UP TO 1800 R.P.M. FOR PUMPING CLEAN LIQUIDS

SERIES F

Four-port design offers 8 optional piping arrangements. Equal size helical gears run in axial hydraulic balance. Standard or bronze fitted; packed box or mechanical seal. Up to 300 P.S.I.—1 to 300 G.P.M. for clean liquids.



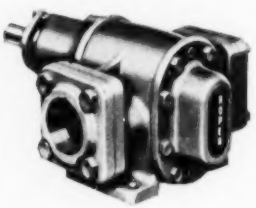


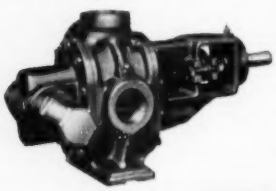
SERIES H

Widely used for hydraulic mechanisms and other applications where high pressures are required. Spur gears provide high volumetric efficiency. Packed box or mechanical seal. Pressures to 1000 P.S.I. — 5 to 75 G.P.M. sizes.

SERIES K

For hydraulic service, fuel transfer or fuel supply. Features helical gears and exclusive Venturi suction and discharge principle in 10 through 50 G.P.M. sizes. Packed box or mechanical seal. 150 P.S.I. — 3/4 to 50 G.P.M.





SERIES 3600

For general purpose work handling thin or thick liquids with suction lift up to 15 feet. Standard or bronze fitted; with or without built-in relief valve. Pressures to 60 P.S.I. — 40 to 300 G.P.M.

SEE OUR CATALOG IN SWEET'S

ROPER

Rotary Pumps

GEO. D. ROPER CORPORATION

168 Blackhawk Park Ave.

Rockford, Illinois

or double anchor bolts assemblies can be obtained in bolt sizes from 3/16 to ½ in and up to 5 in long. A tamping tool is provided free with every 100 assemblies.

Electronic Winding Tester

A newly developed, portable electronic winding tester that can detect a single shorted turn of No. 40 AWG wire was announced by Columbia Technical Corporation, 5 East 57 St., New York 22, N. Y. This new production, maintenance and field-use, and laboratory instrument is designed to detect faults in, and to prevent breakdowns of, electrical motors and generators of all sizes and types, coils, and similar electrical equipment.

Known as the PMD tester it can be used on both AC and DC devices. Unlike most testers, which require that the windings be energized for testing purposes, the PMD test probes generate their own field in the probes. The field oscillates at 300 cycles, in contrast to 60 cycles, which accounts for the very high sensitivity making possible the detection of a single shorted turn in a winding.

The motor tester consists of a power supply unit, a vacuum tube oscillator, a regulator and rectifier circuit, equipped with standard tubes, and a full-view, clearly calibrated meter—all housed in a sturdy portable case. The total weight is 13 lb.

New Dump Truck Hoists and Bodies

A complete new line of hydraulic dump truck body hoists and bodies featuring many new design improvements has been announced by St. Paul Hydraulic Hoist, Minneapolis, Minnesota.

St. Paul claims "more payload per dollar" in their new line because of greater payload capacities per dollar cost—up to 22 per cent more payload than previous models. Fourteen models of this new hoist are available in a selection of capacities from 6 to 25 tons.

The new St. Paul body hoists are said to feature the industry's lowest standard mounting height; advanced lifting point; low operating oil pres-

MANZEL SOLVES OILING PROBLEMS

Manzel lubricates Worthington Diesel

What's Your Problem?

Insure many years of economical, trouble-free service from all types of machinery with *Manzel* Force Feed Lubrication. Adaptable to numerous difficult oiling problems, "Manzel's" can be engineered to *your* requirements. Experienced representatives throughout the country.

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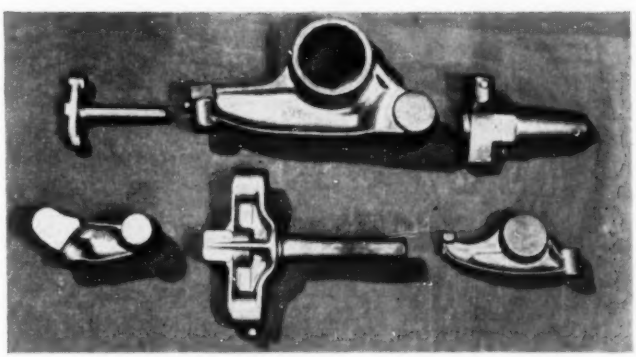
Over 50 Years Experience



Diesel Engine Forgings

Over a half century of experience in producing forgings has earned Indianapolis Drop Forging Company the reputation for quality and dependability.—From experimental forgings in our complete blacksmith shop to mass produced products, the diesel industry has summoned all of the skills and resources of the forging art. Our ability to work at closer tolerance, careful attention to grain flow and fiber formation, sound engineering ability and rapid service contribute to the advancement of the diesel industry. We invite your inquiries.

INDIANAPOLIS DROP FORGING CO.

1300 Madison Ave. Indianapolis, Ind.

THOMAS

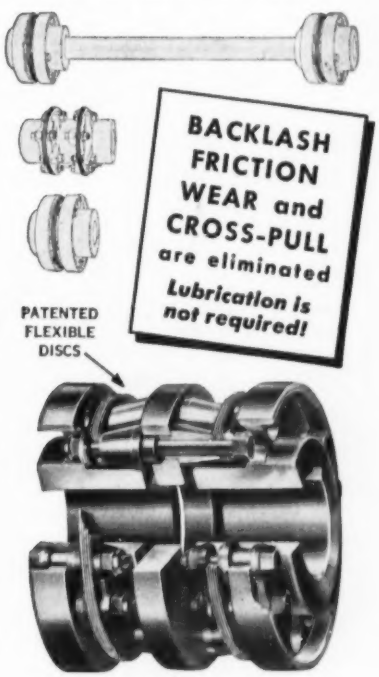
Flexible ALL METAL **COUPLINGS**

FOR POWER TRANSMISSION REQUIRE NO MAINTENANCE

Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

Specialists on Couplings for more than 30 years



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

NO MAINTENANCE PROBLEMS.

ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

sures; and a friction-free roller bearing drive mechanism, including pump and power takeoff for quiet operation.

A stress-eliminating design feature of the new hoists absorbs some of the dumping shocks and permits use of a new principle in hoist design—a flexible sub-frame which is designed to end tendency of rigid hoists to crack or bend when flexed.

New Stopclock for Labs

Andrew Technical Services, 3805 N. Clark Street, Chicago 13, Illinois is currently producing a new stopclock for laboratory and industrial applications.

This clock, which took 3 years in development, is claimed to be superior to conventional stopwatches, because it frees both hands for necessary manipulation during observations. It is also claimed to be extremely rugged and durable in contrast to the delicate stopwatch mechanisms.

Called "Durachron", the clock is spring-wound for portability, has a 4-in diameter dial for reading across a room, and is capable of three different methods of operation.

The operations are: time-out, for timing action which is interrupted during the operation; straight timing, for uninterrupted observation; snap-back timing, in which elapsed time is read while the sweep hand is in motion and the hand is returned to zero simultaneously to start another reading.

Autocar New Diesel Tractor

The Autocar Company, Ardmore, Pa. has developed a new diesel-powered light-weight tractor. The diesel, model DC-65-T, weighs 9750 lb and has a gross combination rating of 50,000 lb.

The power plant is a Cummins diesel with overhead valves. The cylinder block is cast integral with the crankcase and provided with removable cylinder liners. The engine develops 150 hp at 2500 rpm.

The DC-65-T is produced in two wheel-base lengths: 142 in. and 159 in. Standard tires are 10.00/20, but the wheels can take up to 11.00/22.

Shelving for Ton Loads

Equipto, division of Aurora Equipment Company, Aurora, Illinois, has come out with a new line of shelving designed to hold up to one ton on each individual shelf.

The shelves have specially reinforced sides and the centers are equipped with 1 by 1-in high carbon angle irons, 1/8-in thick. Front and rear have U-shaped reinforcing channels, stronger than the angles.

A special stud saves 60 per cent

Low Maintenance Costs

start here...

in the LANOVA combustion system!

When combustion takes place in a Diesel cylinder, pressures shoot up instantaneously to tremendous heights. In ordinary Diesels, the pistons, bearings, rings and wrist pins have to bear the brunt of these life-shortening jarring pressure blows.

In Diesels that use the Lanova Combustion System, however, these important working parts are protected. Combustion pressures are isolated in the Lanova energy cell and fed back into the cylinder in the form of smooth, powerful working pressures that are applied to the piston over a full degree of the power stroke. The result is longer life to working parts, less wear and fewer maintenance problems.

MOST LEADING MAKES of Diesels use the Lanova Combustion chamber principle. But be sure of getting what you want — always look for the distinctive Lanova energy cell design.

Lanova

LANOVA CORPORATION
38-18 30th Street
Long Island City 1, N. Y.

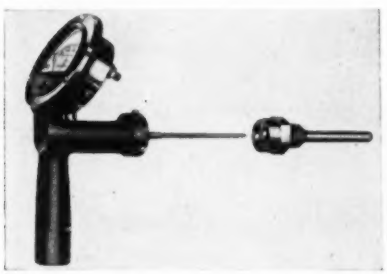
ONE OF AMERICA'S FOREMOST NAMES IN DIESEL RESEARCH AND DEVELOPMENT

assembly time, it is claimed. The stud slips into a hole in the shelf and then into a keyhole in the upright. The shelf is pressed down, and assembly is complete.

No nuts, bolts, or tools are needed for adjustment; all shelves are instantly adjustable on 1½-in centers, and openings are adjustable from front of units.

Bristol Announces Portable Diesel Engine Pyrometer

A new portable diesel engine pyrometer has just been produced by the Bristol Company, Waterbury 20, Conn.



The new instrument is designed for test purposes and for installations where no permanently mounted pyrometer is available. The thermocouples can be installed in each cylinder and in the main exhaust line.

Temperatures can then be checked at any time by inserting the pyrometer prongs into the corresponding receptacles in the terminal head of the thermocouple.

New Pilot Bearing Bushing

The J. G. Jergens Co., 11106 Avon Ave., Cleveland 5, Ohio, has placed on the market, a new type of pilot bearing bushing which the manufacturer states provides a complete, lifetime seal against damaging grit and dust.

According to the manufacturer, the entry of grit or dust into the outer seal actually increases the effectiveness of the seal. The cartridge-type design of the bearing holder protects against thrust loads as well as radial, and offers greater bar support due to the overall length of the bushing.

With use of the new bushings, it is further claimed, tapered bearings can be adjusted to compensate for wear and are adaptable to receive removable slip bushings as well as keys or keyways.

New 37° Flaring Tools

Two new flaring tools for making 37° flares on soft steel, copper, aluminum and fully annealed stainless steel tubing are being placed on the market by the Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago.

A feature of the new units is, that a wide range of sizes of tubing can be flared with a single tool. The tools have a new type of die holder with heat treated, sliding dies for clamping the tubing. A single lever at the end of the die holder provides for clamping the tubing in place.

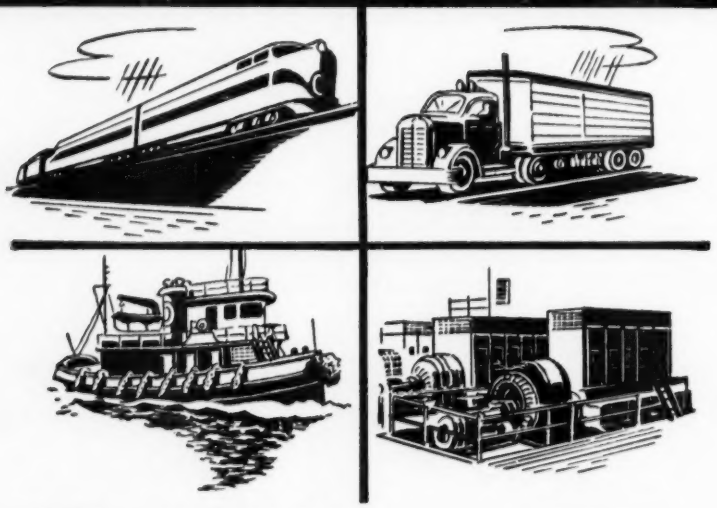
The yoke of the tool slides directly over the end of the die holder into position over the tubing to be flared. This makes it possible to operate the tool with exceptional speed and convenience, the manufacturer states.

Refrigerator on Wheels

A new electric refrigerator on

MONMOUTH
first with the finest
CLEVITE* 77
runs wetter to lengthen bearing life
THE "unfinished" looking finish of a Clevite 77 bearing is an achievement—not a mistake. The problem was to produce a bearing that gave unequalled service life under severe operating conditions. To accomplish this, the most excellent surface action was required—the maintenance of a uniform oil film under conditions of engine overload—lugging and overspeed.
Hundreds of hours of experiment and test were required to develop the lusterless, satin finish you now see on Clevite 77 Bearings. Examine this finish—it accomplishes exactly what was sought.
Clevite 77 Main and Connecting Rod Bearings for replacement use are furnished under our Monmouth Brand and only for applications where engine manufacturers' specifications call for Clevite 77.
*The words Monmouth, Clevite and Micro are registered trade marks of The Cleveland Graphite Bronze Co.
THE CLEVELAND GRAPHITE BRONZE CO.
Cleveland, Ohio
CGB FIRSTS: The development of continuous strip casting, 1929—thinwall babbitt lined steel-backed bushings, 1931—continuous casting of copper lead on steel strip, 1934—tri-metal bearings, 1938—Micro* Bearings, 1939—Clevite 77, 1944—and others which have helped to revolutionize the lined bearing industry.

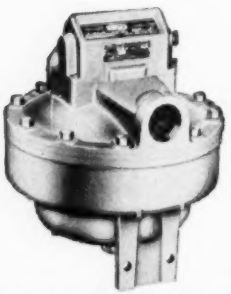
only BOWSER offers . . . everything you need for efficient fuel handling



Micro-Filter

FILTERING

. . . Bowser Micro-Filtered fuel makes clogged injectors a rarity—minimizes engine wear—maintenance costs and downtime are greatly reduced. For maximum operating efficiency—filter every drop of fuel with Bowser Micro-Filters.



METERING

Bowser Xacto meters accurately check fuel oil receipts—record dispensing and provide consumption data on all diesel operated units. Types and sizes to fit every operation. Bowser Xacto meters are "sealer-approved".

Dehydrator

DEHYDRATING

. . . Only DRY FUEL gets through the Bowser Dehydrator—a single pass removes "efficiency robbing" water from diesel fuel. Dry fuel minimizes sticking injectors, carbon formation, downtime and loss of power.

COMPLETE ENGINEERING

As the pioneer and foremost builder of fuel-handling equipment, Bowser can furnish complete engineering service, supply all the necessary equipment, and will assume full responsibility in assuring you complete satisfaction. You can't equal this combination anywhere!

MAY WE SEND YOU MORE INFORMATION?

BOWSER INC. BOWSER 1366 CREIGHTON AVE. FORT WAYNE 2, IND.

Regional Offices: Atlanta • Chicago • Cleveland • Dallas • Kansas City • New York San Francisco • Washington, D. C. • Canadian Plant and Sales, Hamilton, Ontario.

wheels came off the assembly line at the Canadian National Railways' car shops this month.

It is claimed that this is the first time that a mechanical reefer car has been built with its refrigeration equipment suspended beneath it. Standard practice has been to locate it inside the car.

The innovation is made possible by using suspension and an air circulating system. The new car also provides heat in the wintertime, transferring power from the cooling apparatus to a bank of electric heaters in the ceiling.

Equipment slung under the car, includes a four-cyl diesel engine, an electric generator, an air compressor, fuel tanks and thermostatic controls. A feature of the suspension gear is a device which permits the diesel and generator to be swung out from under the car for convenient servicing.

Miniature Speed Changer

The Metron Instrument Company, 432 Lincoln Street, Denver 9, Colorado, has entered into the market a new variable speed changer, it states, opens up a new field of design possibilities in low power speed changing applications.

Speed is controlled by an adjusting knob equipped with friction drag to prevent ratio wander. In addition, lever, push-rod, spur gear, miter gear and worm gear speed controls are available. A dial and pointer on the top of the unit indicates speed ratio.

Easy adaption under rugged conditions are said to be assured by the completely sealed construction, ball bearings throughout, permanent high-low temperature lubricant, and in-line shafts. It is claimed to be ideally suitable where severe ambient conditions are encountered.

New Literature

Al-Fin Brochure

Al-Fin Division of Fairchild Engine and Airplane Corporation, Farmingdale, L. I., N. Y., has issued a new brochure dealing with the Al-Fin process. This is a casting method of molecularly bonding aluminum to ferrous metals.

The brochure contains more than fifty illustrations of various bonded bi-metallic applications, and presents a representative selection of the process' uses in diverse industrial fields. Al-Fin may offer the answer to design problems involving heat transfer, joining, bearing surfaces, weight saving, cost reduction or oxidation resistance.

Included in the brochure are basic engineering design data. The names of the 16 firms so far licensed to use the process in the United States and other countries are given.

Flow Meter Catalog

Fischer & Porter Company, 6390 County Line Road, Hatboro, Pa., has issued a new catalog describing variable-area flow meters with newly developed tapered metal metering tubes.

This publication discussed armored "flowrator" meters which are designed for both high temperature and high pressure and for use where liquid hammer and hazardous fluids make ordinary meters impractical or dangerous. It also devotes an entire section to meter extensions and extension combinations which are available to the armored meter user.

"How to Run a Metal Working Shaper"

South Bend Lathe Works, South Bend 22, Indiana, has issued a handbook entitled, "How to Run a Metal Working Shaper." This is designed to be a manual for the 7-in. shaper.

Thoroughly covering the set-up and operation of the metal working bench shaper, this 32-page handbook will aid the experienced machinist as well as the apprentice. Over 65 photos, diagrams and exploded views show the internal parts of a shaper, how to grind differently formed tool bits for shaper cuts and how to handle the many job set-ups used in shaper work.

Foundry Mechanization Booklet

How a foundry can be mechanized for increased production, better castings and improved working conditions is the topic of a new Book No. 2439, published by Link-Belt Company, 307 N. Michigan Avenue, Chicago 1, Illinois.

JOHNSON
Sleeve Bearings

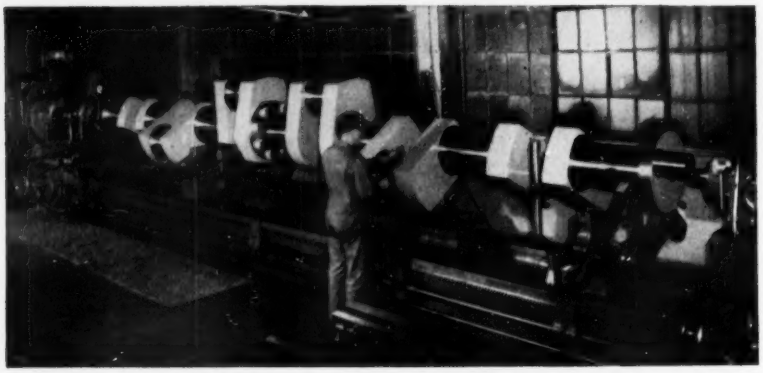
Yes for every type of diesel, Johnson Bronze designs and manufactures sleeve bearings. Each application demands a special study of operating and service conditions. Based on this information Johnson engineers will recommend the style of sleeve bearing to suit and will cooperate in designing it.

JOHNSON BRONZE CO.
470 South Mill Street • New Castle, Pa.

Sleeve Bearing Headquarters Since 1901

JOHNSON JB BEARINGS
Sleeve-Type

DIESEL CRANKSHAFT REPAIRING AND REFINISHING



Picture shows a thirty-foot crankshaft with 13″ diameter journals which was broken through the No. 6 web— receiving final inspection after new crank and center coupling sections were installed and machined to original tolerances.
Shafts of all sizes and types successfully repaired and refinished.
Call, wire or write for particulars on our field repairs and emergency service.

WASHINGTON IRON WORKS, INC.
Established 1876
SHERMAN, TEXAS

Consult ELLWOOD on all Your Forging Requirements

Quality Precision Crankshafts For Diesels — Since 1910 . . .

ELLWOOD CITY FORGE COMPANY
CRANKSHAFTS · CONNECTING RODS
MACHINE FORGINGS
ELLWOOD CITY, PENNA.

This is a selection of actual case histories, foundry layout drawings and installation photographs. Contrasts are made between original methods and modern mechanical handling in molding, pouring, cooling and sand preparation through use of sand reconditioning machinery, shakeouts, and conveyors for molds, sand and castings.

Foundries handling gray iron, malleable, steel, brass, aluminum, magnesium and other metals are represented.

Smoke Recorder Bulletin

A brief, 2-page, 3-color bulletin is now available on a smoke recorder for the use of plant and combustion engineers interested in recording stack smoke density and combustion performance. Wiring and installation diagrams are included.

Write to Ess Instrument Company, Bergenfield, New Jersey and request Bulletin 512.

Aeroquip Bulletin

Aeroquip Corporation, Jackson, Michigan, has issued a new bulletin, No. 223, which describes, in condensed form, many of the company's products.

Included are specifications on hose assemblies and components, flange-type hose fittings and self-sealing couplings.

National Supply Bulletins

Bulletin No. 5203, just released by the National Supply Company, Springfield, Ohio, gives complete design features, capacity tables and dimensions of its Atlas Model 45 stationary diesel. Suitable for installation in institutional plants, oil fields, quarries and general industrial plants, the engine is available in either naturally aspirated or supercharged types.

The 8-page bulletin describes the various 6- and 8-cyl. models available in capacities from 240 to 600 hp., gives specifications of component parts, and lists standard as well as extra equipment.

Bulletin No. 5201 gives complete design features, capacity tables and dimensions of its Superior Model 60

(*Continued on page* 82)

here's how

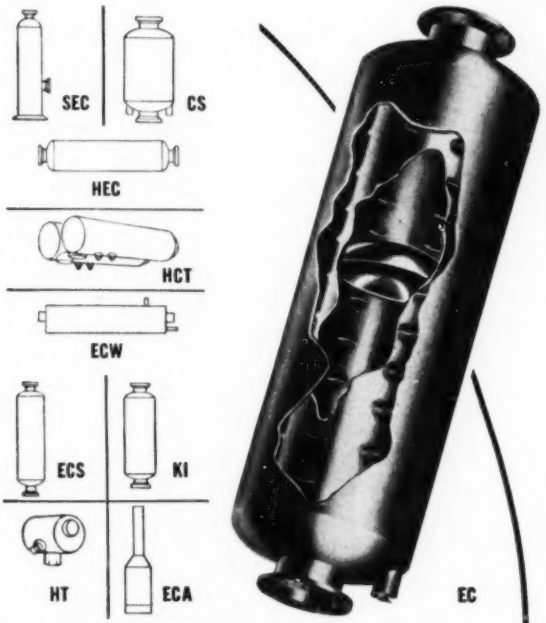
Kittell SILENCERS

stop damaging back surge... reduce engine noise to a whisper!

The Kittell method of handling a pulsating flow is unique. As the burst enters the silencer it is quickly bled off by means of a special perforated tube...completely eliminating power loss from atmospheric back surge.

The gases are then directed through louvres along the outer shell, which cools them and reduces their volume. They are then directed back through more louvres into the center of the silencer and out into the atmosphere.

This method of controlling the expansion of the hot gases, and using the kinetic energy in the moving mass of air to direct the gases through a series of louvres, smooths out the pulsations and produces a steady, whisper-quiet exhaust flow. Large free-flowing passages prevent plugging due to excessive carbon or sludge deposits.



Immediate delivery on all standard models!

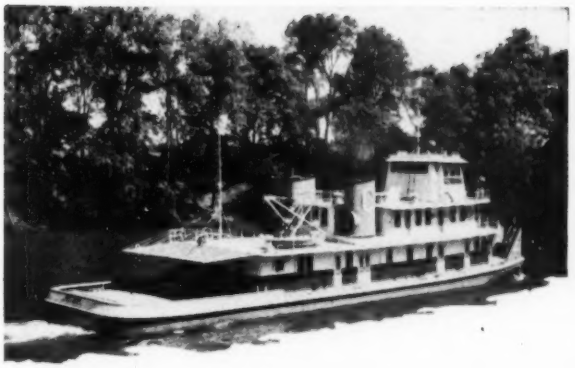
All standard Kittell silencers and spark arrestors-silencers, carefully made from heavy steel and welded throughout for longer life, are immediately available for all types of engines. Special stainless steel, ceramic coated and specific purpose equipment are also available. We will be happy to quote prices and delivery dates to your specifications.

Send today for complete catalog.

Kittell Muffler & Engineering, Inc.

915 South Santa Fe Ave., • Los Angeles 21, California

12 years of silencer engineering and fabricating experience



"SO DEPENDABLE THAT WE'VE STANDARDIZED"!

"For the past two years we have been using Surrette Batteries on our six towboats and tugs, and many of our barges which have engine-driven pumping units," says Mr. Scott Chotin, an official of the Chotin Transportation, Inc., New Orleans, La., one of the leading towboat concerns of the inland waterways. "The Surrette 8-volt type, used to start the auxiliary diesels, has impressive characteristics; their specially-engineered marine design, double insulation, extra long life and high capacity. They provide the necessary high amperage for quick starting of the diesel engines. We unhesitatingly recommend them for the marine industry."

BIGGEST VALUE & CAPACITY, AT NO EXTRA COST

★ GREATEST CAPACITY IN LEAST SPACE. 25% more than conventional storage batteries. Capacities that will crank biggest Diesels—up to 1600 H.P. Extra capacity enables you to enjoy the conveniences of additional electrical equipment.

★ LONGEST LIFE, HIGHEST POWER, PER POUND OF WEIGHT.

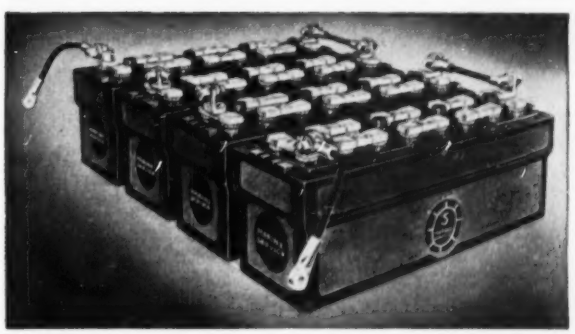
★ THICK, HIGH, POSITIVE PLATES. DOUBLE INSULATION.

★ SPECIALLY ENGINEERED, SPECIAL MATERIALS, FOR MARINE AND INDUSTRIAL USE: Extra heavy fittings; genuine hard rubber containers.

Ask your dealer about Surrette Batteries, the choice of experts, and for Specification Sheet M-I. FINEST AT ANY PRICE—SIZES FOR MARINE AND INDUSTRIAL USE. Write us if your dealer cannot supply you.

SURRETTE STORAGE BATTERY CO., INC.
Jefferson Ave., Salem, Massachusetts

Surrette STORAGE BATTERIES



and 80 stationary diesels. Suitable for installation in utility plants, institutions, oil fields, quarries, dredges, and general industrial plants, the engines are available in either supercharged or naturally aspirated types, and for straight-diesel or dual-fuel operation.

The 8-page bulletin describes the different 6 and 8-cyl. sizes available in capacities from 410 to 1440 hp., gives performance data, specifications of component parts, and lists standard as well as extra equipment.

Diesel Engine Alarm Bulletin

Bulletin No. 4306-B just released by The National Supply Company's Engine Division, Springfield, Ohio, describes wall and floor mounted cabinets incorporating the necessary alarm and shutdown devices to safeguard the operation of stationary diesel engines.

The 4-page folder lists the protective relays, signals, gauges, etc., mounted on the cabinets and explains their operating sequences.

Briggs OIL CLARIFIERS ON STATIONARY-TRANSPORT-MARINE DIESELS PAY OFF BIG...

...because they keep lube and fuel oils clean--physically and chemically!

11 YEARS AGO, the Rural Cooperative Power Association of Minnesota started using Briggs clarifiers. Now ten, including 3600 H.P. diesel engines in their five operating plants, are Briggs-equipped.

Satisfaction like this proves Briggs' performance is superior. Operating men specify Briggs wherever diesel engines are used. These men know that over the years Briggs keeps lube and fuel oils clean—physically and chemically—keeps engines running better, longer.

Let us run a check on your present filtered oil—send a sample and full engine data. We will put it through our laboratory and give you the report. If new filters are needed, we will recommend type and size.

Briggs Has The Right Filter!

★ A Briggs catalog belongs in your file—write for one TODAY!

Briggs PIONEERS IN MODERN OIL FILTRATION

THE BRIGGS FILTRATION COMPANY
RIVER ROAD, WASHINGTON 16, D. C.

FOR MORE THAN A QUARTER CENTURY

Preventive Maintenance Manuals

A highly practical maintenance program to insure continuous and efficient operation of gas and diesel engines has been developed by the Cooper-Bessemer Corporation.

This program is detailed in two new manuals. One covers gas-diesel and diesel engines; a second covers gas engines. In contrast to the usual periodic 8000-hour overall check or the progressive-type maintenance schedule, these manuals show how to perform continuing checks on engines while in service to accurately forecast internal conditions of the engines and anticipate operation needs.

The manuals can be obtained for $2.00 a copy by writing H. T. Watson, The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

Pressure Gauge Bulletins

Brown Instruments Division of the Minneapolis - Honeywell Regulator Company has issued a series of specification sheets.

Specification sheet 708 describes indicating and recording pressure gauges. Sheet 710 describes indicating and recording pressure gauges. Sheet and recording pressure gauges with pneumatic control and sheet 709 with electr-o-vane control. Construction and engineering details are included.

Centrifugal Pump Films

Now available through Allis-Chalmers General Machinery Division, Milwaukee 1, Wisconsin is the first in a series of a new education service to industry in the form of three 35mm sound filmstrips on centrifugal pumps. Each film runs about 30 minutes.

"How and Why of Centrifugal Pumps" shows parts and nomenclature, theory of operation, measurement of characteristics, and interpretation of curves.

"Pump Maintenance" illustrates how to set up a centrifugal pump, starting procedure, lubrication, packing, maintenance, mechanical seals, piping tips, and the keeping of operating records.

"Covering All Angles" describes the selection of a pump and gives information required to figure its installation.

Speed Reducer Bulletin

A 28-page bulletin describing the entire line of new Crofts "radiation" fan cooled speed reducers, featuring a universal mounting arrangement, has been made available by National Transmission Products, Inc., 684 Broadway, New York, N. Y.

Wire bound and illustrated in full color, the diagrams, photographs and text give complete details on operating data, dimensions, models available, typical installations and part descriptions.

Gear Chuck Catalog

Garrison Machine Works, Dayton, Ohio has issued a new catalog about their products—pitch line control gear chucks. These gear chucks are custom made.

The catalog gives a brief description of the plant, the service facilities (consultation, engineering, production) advantages of custom-built chucks, and then shows photos of some typical installations.

Babbitting Bulletin

A new booklet published by Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y., outlines the basic steps for the prevention of common bearing failures.

"Hints on Babbitting Practice" covers everything from the choice of metal for a particular bearing application through the correct pouring practice to in-service maintenance.

Condensed Filter Catalog

Commercial Filters Corporation, 18 West Third St., Boston 27, Mass., has issued a 4-page booklet, giving thumb nail descriptions of standard models of "Fulflo" filters for microscopic clarification of industrial liquids and gases, and providing detailed descriptions of Honeycomb filter tubes.

It gives essential data on single and multi tube filters of capacities from 6 to 60,000 gph. Steel, brass, and rubber lined steel and stainless steel models, plus special applications are described.

"Prevent Down Time"

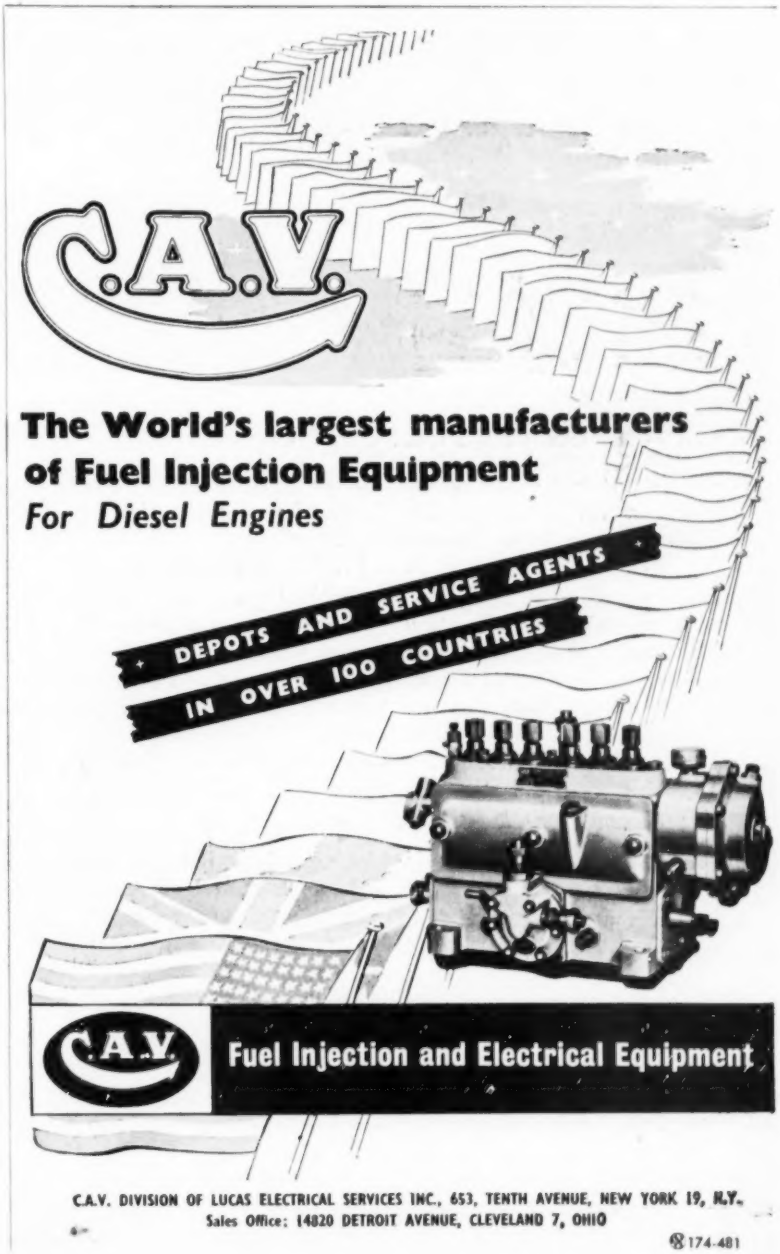
Caterpillar Tractor, Peoria 8, Illinois, has issued a new booklet entitled, "Prevent Down Time".

"Down time is that period when, due to mechanical failure, your equipment is not working and not earning." The subject of this booklet is preventive maintenance. Illustrations show how the "Cat" dealer offers complete facilities for the maintenance of equipment. The maintenance program includes routine care by the operator plus expert help from the dealer.

Dynamometer Cooling Catalog

Young Radiator Company, Racine, Wisconsin has issued a catalog, No. 6051, on heat transfer products used in dynamometer cooling.

This piece includes illustrations and specifications for jacket water coolers, "mono-weld" radiators, and heat exchangers, together with a typical dynamometer cooling installation diagram. Emphasis is placed on the engineering of these products to accomplish balanced closed-system cooling.



C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., 653, TENTH AVENUE, NEW YORK 19, N.Y.
Sales Office: 14820 DETROIT AVENUE, CLEVELAND 7, OHIO
174-481

Field Notes

Compact Diesel Ups Production

This two-cycle diesel engine recently installed on a Telesmith portable rock crusher is saving its owners over an hour's set-up time on each move to a new location.

Howard Haferman of Haferman and Stark, sand and gravel contractors of Jordan, Minnesota, owners of the rig, said this was due to the compact size of the new engine which permitted its installation directly on the rig. The previous engine, which was almost 50 per cent greater in size and weight, required a separate vehicle for mounting.

Haferman also pointed out that despite its compact size, the additional power of the new engine, a six-cyl GM diesel, stepped up the rig's production some 20 per cent. In the photo showing the new installation is Haferman and R. E. Murray, diesel engine manager of the Borchart-Ingersoll Company of St. Paul.

New Nordberg Distributor

Appointment of Olson Equipment Company, 2930 Blaisdell Avenue, Minneapolis, as distributor for Nordberg 4FS diesel engines in Minnesota and northwestern Wisconsin is announced by Nordberg Manufacturing Company.

Manufacturers and distributors of construction equipment and supplies, the Olson firm began operation in 1945. With its modern headquarters in Minneapolis, the company has the facilities to repair all types of engines and its service personnel has had extensive training in this field. In addition to its central sales office, Olson Equipment Company has five experienced salesmen in the territory.

New Diesel Repair Shop For Baltimore & Ohio At Pittsburgh

A new diesel heavy repair shop for the Baltimore & Ohio railway system, will be located at Pittsburgh, Pa.

With a constantly expanding fleet of diesel locomotives, totaling 738 units in service and on order, the need for a heavy repair shop was urgent, the company discloses. Already a year in construction at a cost of $1,030,000 to date, this shop will be the major diesel repair point on the entire B&O. It will have a maximum repair output of 200 diesel units each year.

August 31, 1951, saw the last of the steam locomotives to be repaired at this spot in the old repair shop. On this date, steam locomotive repairs were terminated and diesel repairs were instituted.

New GM Metallurgy Building

A new General Motors experimental foundry at the company's technical center near Detroit has just been opened. The new metallurgy building is the first completed structure in GM's laboratories research group. It is equipped for experimental melts of all common metals, outfitted with the latest laboratory and testing equipment available for metallurgical research, as well as pilot plant areas for experimental production operations.

A second building now under construction is a mechanical building.

Instrumentation Seminar

The third annual seminar in industrial instrumentation will be held for professors of engineering in Philadelphia, August 18 to 22, it was announced by the Industrial Division of the Minneapolis-Honeywell Regulator Company.

The 5-day program is designed to familiarize the faculty of engineering schools with recent advancements in industrial processes and the attendant development of automatic instrumentation. This phase of engineering, as explained, is covered only on a broad basis in the conventional curriculum. The program will also include discussions of mutual problems of engineering colleges and the instrument industry.

The seminar will be held in the company's training school in Philadelphia.

New $1,000,000 Diesel Repair And Servicing Shop For Rock Island

The Rock Island Lines has started construction of a $1,000,000 diesel repair and servicing shop on Chicago's south side, it was just announced.

The big facility will take the place of the roundhouse which was built at the turn of the century. Part of the roundhouse has already been demolished. The remainder will come down when the new building is completed.

The diesel house construction will be of steel frame and brick, and will have six service tracks to accommodate a total of 12 diesel units at one time. In addition, there will be a wheel storage track and a heavy repair track. Here all passenger and suburban engines operating into and out of the Chicago area will receive their service and repairs.

Maintenance Show & Conference Set for Cleveland

A 12-man group of industry executives has been chosen for the advisory board of the Plant Maintenance Show and Conference to be held at Cleveland, Jan. 19 to 22, it was revealed.

In the show division, 350 companies are expected to conduct exhibits; some displays are scheduled to be larger than 3000 sq ft. Total display space will be 75 per cent greater than the show held in January of this year.

More than 60 sessions are planned for the conference division. Industries will have their maintenance problems discussed in separate sessions, in addition to panels devoted to maintenance policies of top management.

Advance registration cards may be obtained from Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

Leslie Co. Increases Engineering Facilities

A new wing providing increased engineering space has been added to the plant of Leslie Co., Lyndhurst, New Jersey, manufacturers of pressure and temperature regulators and controllers, to cope with the growing needs of the industry.

The new department includes a larger drafting room and new test laboratory, providing additional facilities for long range research and development to add new equipment to the company's line of products.

Honeywell Ups Jet Research

A new jet engine laboratory is being established by the aeronautical division of Minneapolis-Honeywell Regulator Co. to speed development on jet engine controls.

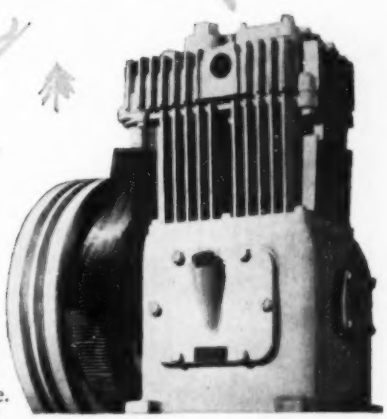
Equipped with a network of complex electronic computers, controllers and relays, the new facilities which include a separate building for this work, will permit jet controls to be designed and proved without ever leaving the ground. Not even an engine will be needed.

The electronic system, heart of which is an analog computer, makes it possible to simulate the characteristics of any jet engine under all kinds of flight conditions. Performance of controls is recorded automatically. Engineers can then quickly determine whether the engine "likes" the type of control being tested.

(*Continued on page 87*)

AND IN YOUR BUSINESS . . .

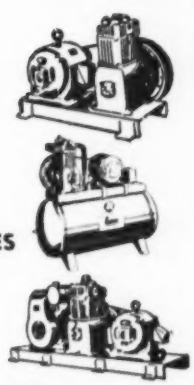
Quincy COMPRESSORS



When it comes to DEPENDABLE COMPRESSED AIR SUPPLY, Quincy Compressors can be as important as the mountain climber's lifeline. Quincy builds a complete line of modern, compact, rugged compressors in sizes from 1 to 90 c.f.m.

There's a Quincy Compressor for *your* job! Depend on a Quincy specialist to help you select the type and size to meet your specific needs.

Write Dept. J-26 for details



Only Quincy OFFERS ALL THESE FEATURES

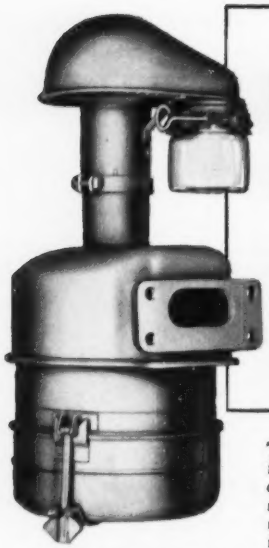
- Timken Bearings
- Lynite Rods
- Perfectly Balanced Crankshaft
- Copper-Finned Intercooler
- Automatic and Positive Lubrication

QUINCY COMPRESSOR CO.

QUINCY, ILLINOIS

Branch Offices: NEW YORK PHILADELPHIA DETROIT CHICAGO ST. LOUIS DALLAS SAN FRANCISCO

Manufacturers of Air Compressors Exclusively



Donaldson
Air Cleaners
are
EASY TO SERVICE!

CUSTOM-BUILT TO FIT YOUR ENGINE

Write our engineering department for air cleaner recomendations.

The simplicity and speed of servicing Donaldson Air Cleaners encourages regular attention by the machine operator. No tools are needed to remove oil cup. Cleaning cup and re-filling with oil is a two-minute job. Removable tray makes cleaning out chaff, lint, leaves and larger foreign particles simple and fast.

DONALDSON CO. INC.
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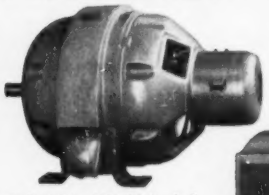
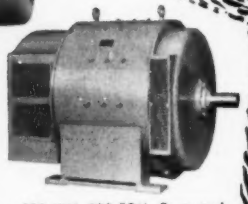
Donaldson *Air Cleaners Mufflers*

CHAMPION PERFORMERS



93.8 KVA, 900 RPM, A.C. Generator with Direct Connected Exciter.



200 KW, 900 RPM, Protected, Two Bearing D.C. Generator.

COLUMBIA

A.C. AND D.C. GENERATORS

For the greatest exhibition of quality and service use performance proved Columbia A.C. and D.C. Generators. Available for coupled service, belt drive, single or two bearing.

A.C. Generators: 6¼ to 1000 KVA
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Protected Territories Available to Qualified Sales Engineers

COLUMBIA ELECTRIC MFG. CO.
4537 HAMILTON AVE. • CLEVELAND 14, OHIO

What Do You Know!

See how much you know about the different phases of the internal combustion engine industry by indicating your choice of answers to the questions below. Then, compare. Correct answers appear on page 89.

1. Turbochargers are not suitable for use on vehicular applications of high-speed diesel engines.

   a. True b. False

2. Which single factor listed will have the greatest effect on acceleration of a turbocharged engine?

   a. Exhaust energy c. Rotor inertia
   b. Turbocharger size d. Manifold size

3. Vehicle acceleration rate is largely dependent on:

   a. Max. engine bhp c. Engine rpm
   b. Torque curve shape d. Potential excess power at a given speed

4. Reliable life expectancy of ignition systems for large natural gas engines is limited by:

   a. Transformer design c. Breaker contact life
   b. High tension leads d. Condenser durability

5. The purpose of breaker contacts or the pulse from a pulse generator is to:

   a. Interrupt the transformer primary circuit
   b. Interrupt the transformer secondary circuit
   c. Cause rapid flux change in the transformer core.

   Select one most descriptive of the desired effect.

6. Diesel wheel-type farm tractors have demonstrated their ability to do the work of gasoline-powered units using approximately.....the qualtity of a cheaper fuel. Select one figure below to fill out the blank.

   a. ¼ c. ½ e. ¾
   b. ⅓ d. ⅔

7. Any lube oil meeting the U. S. Army Specification 2-104B will meet the new MIL 0-2104 specification.

   a. True b. False

8. In operation of diesel-powered vehicles, over-the-road operation at high speeds is more severe than city-type stop-and-go service.

   a. True b. False

9. The new API Severity Ratings are not intended for all sizes of diesel engines.

   a. True b. False

10. "Transition" on diesel-electric locomotives can be roughly compared to one of the following:

    a. Stepping on car accelerator
    b. Shifting gears on a car
    c. Decelerating by taking foot off accelerator

11. Principal difference between relays and electro-magnetic contactors is:

    a. Amount of current carried c. Size
    b. Principle of operation d. None

AIEE Meeting Held

Electrical engineers and scientists from many parts of the country attended the Pacific General Meeting of the American Institute of Electrical Engineers in Phoenix, held August 19-22.

The meeting was one of four yearly gatherings of the Institute, which has a world-wide membership of 42,000. They are held in different sections of the country to afford members the opportunity to attend at least one general meeting each year.

Technical sessions and symposiums were arranged on western mining applications, metering and relaying, feedback control systems, industrial power systems, power generating and lighting.

GE Generator for Chile

General Electric has recently finished building an 8750-kva generator to be used by the Anglo-Lautaro Nitrate Corp. in Chile.

The unit, said to be the largest of its kind ever to be built in this country, weighs 86 tons, stands 21 feet high, and measures 24 feet across. It is powered by an 8950-hp, 12-cyl Nordberg diesel engine, also said to be the largest ever built in this country. The unit was constructed in Schenectady.

New Ampco Distributor

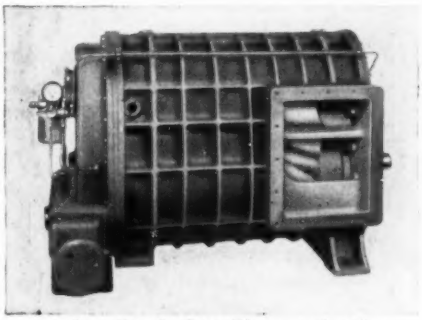
Ampco Metal, Inc. announces the appointment of the Western Oxygen Co., 2949 Sixteenth Ave., S.W., Seattle, Washington as exclusive distributor of the company's products in that area.

Chain Belt Company Wins Safety Award

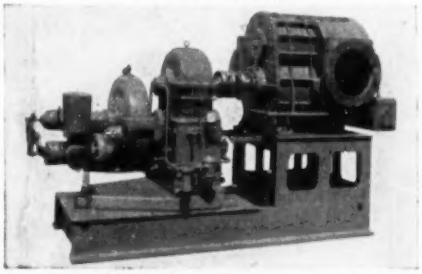
The National Safety Council presented an award of merit to 300 employees in the Construction Machinery Division of Chain Belt Company of Milwaukee. The award was for the performance of 1,297,204 manhours of work, from May 1950 to January 1952 without a disabling injury.

According to the company, this accident-free performance is continuing. Their record now stands at 1,583,000 manhours of work without a disabling injury.

STANDARDAIRE BLOWERS *for easy* ADAPTABILITY



Standardaire Blower with side intake and discharge.



Standardaire Blower with turbine and gear drive unit.

Standardaire Blower with side intake and end discharge.

Installation showing three Standardaire Blowers.

To meet the specific needs for industry, Standardaire's unique design provides for maximum flexibility in meeting unusual requirements for intake and discharge connections. For example, the blower intake or discharge ports can be located on the end, top, bottom or sides ···· two intake or discharge ports may also be provided when necessary. These exclusive features, plus provisions for direct drive by a power unit of your choice, are typical examples of Standardaire's adaptability.

Standardaire Blower with single top intake and two side discharge ports.

Write . . .

Read Standard Corporation, Dept. 57
370 Lexington Ave., New York 17, N.Y.
BLOWER-STOKER DIVISION

AXIAL FLOW STANDARDAIRE BLOWER

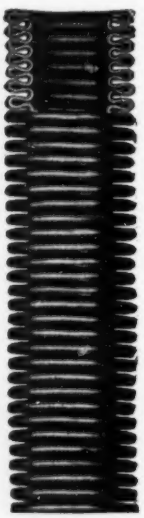
READ STANDARD CORPORATION

NEW YORK · CHICAGO · YORK · LOS ANGELES

You can do that with ATLANTIC seamless diesel hose which requires no maintenance whatever.

Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.



Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

ATLANTIC

METAL HOSE CO., INC.

109 West 64th St.,

New York 23, N. Y.

Temperature Standardization Program Extended

The National Bureau of Standards under the U. S. Department of Commerce is extending its temperature standardization program toward the extremes of the temperature scale. This is a result of the increasing need for reliable temperature measurements at both very high and very low temperatures.

New instruments and methods of calibration are being developed and research efforts are being directed toward extension of the International Temperature Scale for greater accuracy and reproducibility. This work is part of a continuing program to provide American science and industry with temperature standards and measurement methods over as broad a range and to as high a precision as possible.

The importance of accurate temperature measurement at the extreme ends of the scale, has been greatly increased with the rapid technical developments of recent years. Many improvements in processes for production of steel, glass, gasoline, and other commodities, have resulted from the increased precision that is being attained in the measurement and control of temperature.

Disconnect Switches for India

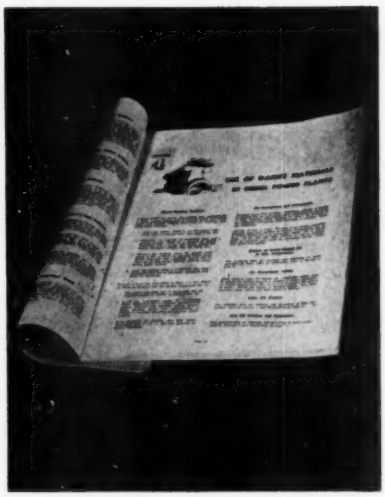
The Government of India received a shipment of outdoor substation apparatus from Westinghouse, recently. Included in the equipment were 68 high-voltage type V disconnect switches. Thirty-three 161-kv three-pole switches, many with grounding blades and four vertically mounted, and thirty-five 196-kv switches made up this shipment.

Special RR Flat Car Built for Westinghouse

A specially-designed railroad flat car to carry extra-heavy equipment has been built for Westinghouse by the Thrall Manufacturing Co. of Illinois.

The flat car is about the same length as an average box car but is equipped with extra-heavy journals so

(*Continued on page* 90)



FREE—

How to Speed Diesel Maintenance

THIS illustrated digest contains a wealth of sound, practical ideas to expedite Diesel maintenance, keep operating costs low and extend equipment life. Gives details on such subjects as:

- Cleaning filters
- Desludging lube oil coolers
- Descaling jacket water coolers
- Degreasing engine parts before repair
- Steam-detergent cleaning
- Plant maintenance cleaning

Manual also discusses tested Oakite procedures for streamlining maintenance in steam control stations and electric power plants.

FREE copy of this 16-page digest yours on request. Consult your local Oakite Technical Service Representative. Or write address below. No obligation.

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SPECIALIZED INDUSTRIAL CLEANING
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MATERIALS • METHODS • SERVICE
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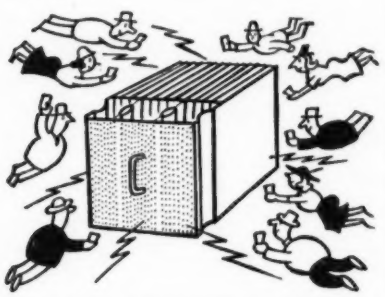
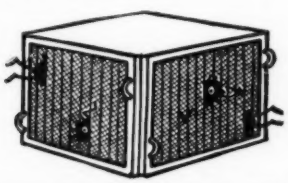
AIR-MAZING FACTS

BY O. SOGLOW

WATCH MY DUST! A lump of charcoal the size of a pack of cigarettes has an area of about 22 square inches. But when you crush it to fine dust, its total area is increased to the size of a city block.



GETS BUSINESS ELECTRONICALLY! Leading businessmen know that super-clean air means more business for stores, restaurants, offices and other commercial establishments. Electro-maze electrostatic air filters provide super-clean air – remove dust, dirt, smoke and pollen. Filter cells slide out like file drawers for easy servicing. "Building block" construction cuts installation time, reduces cost.



DOGHOUSE FOR DUST! Air-Maze DH ("dog house") filter assemblies on intake pipes protect engines against sucking in dust and dirt. All-metal construction. Filter cells can be removed quickly for servicing. Available for indoor or outdoor applications.

WHETHER YOU BUILD OR USE engines, compressors, air conditioning and ventilating equipment, or *any device using air or liquids* – the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

What Do You Know!

(*Answers to questions on Page 86.*)

1. Correct answer is "b". The Cummins Diesel Special proved this. For details of the development of turbochargers for this service see article on Page 42.

2. Correct answer is "c". See article referred to above for details.

3. "d" is correct. However, "b" and "c" will influence power potential since torque times rpm at a given speed will determine available power. See article mentioned above.

4. Correct answer is "c'. Breaker contact life in magneto or battery systems is the most frequent source of trouble. For details and new developments, see article on Page 54.

5. Most descriptive is "c". Primary circuit interruption or an impressed pulse serve only to get rapid flux change in core to induce high-voltage current in the secondary circuit. See the article mentioned above.

6. Again, "c" is correct. Farm tractors are following the pattern of other vehicular applications. See article on Page 59 for details.

7. "b" is correct. It is a half truth, some will and some won't. For full discussion of this and other points see article on Page 44.

8. Again, "b" is correct. Tests are showing the need for high-additive oils in stop-and-go service. See article mentioned above.

9. Correct answer is "a". New API ratings worked out with SAE and engine builders are specifically for the smaller high-speed type of engine. See article referred to above.

10. Correct answer is "b". Altering of traction motor electrical circuits to obtain higher torque in analogous to shifting gears. For discussion of this and other phases of diesel-electric locomotives, see the second part of a three part series on locomotive electrical fundamentals on Page 62.

11. "a" is correct. It follows that "c" will also generally be true. See article mentioned above.

★ HARD CHROMIUM PLATING SERVICE

★ IRON PLATING SERVICE

★ MAGNAFLUX SERVICE

Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Damaged journals restored to size by iron plating and hard chromium finish plating.

CRANKSHAFT GRINDING SERVICE

Established 1924 . . . 27 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!

NATIONAL WELDING & GRINDING CO. 2929 CANTON ST. DALLAS 1, TEXAS

THE LARGEST CRANKSHAFT GRINDING MACHINE IN THE WORLD USED IN AN INDEPENDENT REPAIR SHOP

that it can carry all but the very largest generators as completely assembled units. The car has 16 wheels on four trucks, instead of the usual eight wheels on two trucks. It weighs about 106,000 lb.

The company will now be able to ship most of its extremely heavy units completely assembled, whereas it was formerly necessary to disassemble them for shipment. This will result in a saving of time and effort at the power house where the generators will be installed.

New Rolling Mill For ALCOA

A new rolling mill, costing approximately $4,500,000 will be installed at Aluminum Company of America's works in Davenport, Iowa by late 1953.

Equipment for the mill, which the company claims will be one of the largest in the industry, will be operated under terms of a lease arrangement with the U.S. Air Force. The Air Force, in turn, will have first call on production of the mill.

One million dollars of the company's own money will be spent on the project. The mill, capable of rolling widths up to 10 ft through four-high stands of rolls, will be able to handle hot or cold ingots, and will be reversible.

$75,000,000 Loan For Allis-Chalmers

The Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin announces that arrangements have been completed with a group of insurance companies, for a loan aggregating $75,000,000. Part of the money will be used to complete the company's plant expansion program.

Diesel Electric Set Keeps Airport Operating

Pilots scheduled to land their planes were in luck when outside power failed at Decatur Municipal Airport. A new diesel Caterpillar electric set was ready to go into action. Installation had just been completed the day before.

For 11½ hours, until normal power was restored, this standby unit kept the airport in operation. The beacon, runway lights, communications and other facilities were protected against power failure.

Attendance New High At Anniversary Meeting Of ASTM In New York

The 50th anniversary meeting of the American Society for Testing Materials, held in New York City, had 165 papers and 70 reports from the technical committees presented before it.

The program, arranged to commemorate the Society's formal incorporation as a national technical society in 1902, attracted a total of 2606 engineers and materials men, the official registration. Four hundred and fifty meetings were held, ranging from one-half hour to three days.

Seventy-five new specifications were approved for publication. Some 90 tentatives were recommended for adoption as formal standards subject to letter ballot. About 270 standards and tentatives were revised.

PIONEERS are LEADERS

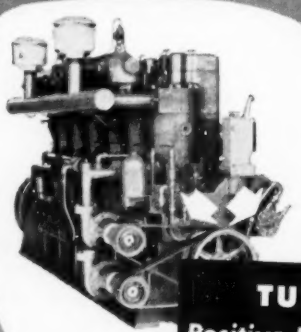
For nearly twenty years the makers of Winslow Filters have been pioneering the idea of giving engines and machinery better protection by keeping ALL your oil clean through the use of *Full-Flow* filtration. Along with pioneering the principle, these men have also held original patents on the successful application of that principle. You will profit by depending on the leadership that is enjoyed only by such pioneers.

WINSLOW FILTERS

Winslow Engineering Company

4069 Hollis St., Oakland 8, Calif.

For POSITIVE LUBRICATION



TUTHILL Positive Displacement PUMPS

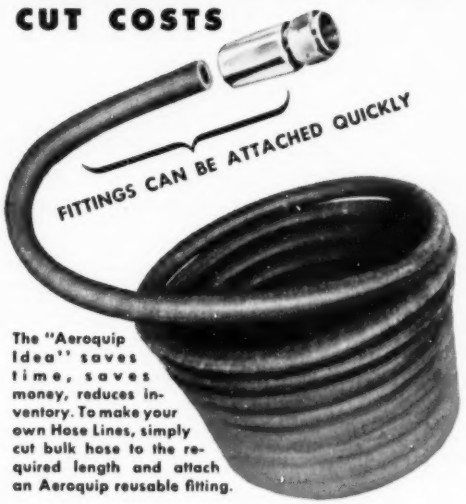
There's no place for guesswork in the lubrication of diesel engines and power units. Tuthill pumps provide a positive method of lubricating and scavenging. Dependable, economical automatic reversing pumps and stripped models for incorporating directly into the design of your engine are available to meet any lubrication requirement. Send your specifications for recommendations on the Tuthill pumps best suited to your needs.

25th Anniversary

TUTHILL PUMP COMPANY

939 E. 95th Street, Chicago 19, Illinois

Aeroquip
FLEXIBLE HOSE LINES CUT COSTS



The "Aeroquip Idea" saves time, saves money, reduces inventory. To make your own Hose Lines, simply cut bulk hose to the required length and attach an Aeroquip reusable fitting.

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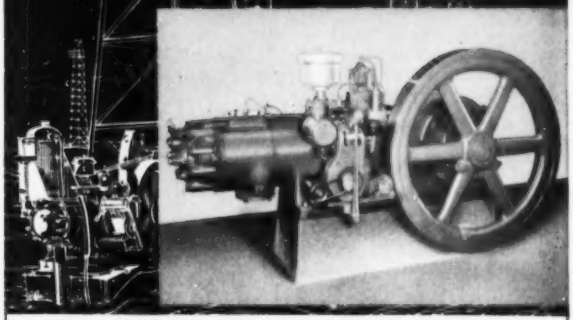
JACKSON, MICHIGAN

FLEXIBLE HOSE LINES • DETACHABLE, REUSABLE FITTINGS • SELF-SEALING COUPLINGS • BREAKAWAY COUPLINGS • HYDRAULISCOPE
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

For low-cost power rely on
LORAIN Multi-Fuel ENGINES



55 HP Lorain Model DA with gasoline starter

...full line from 10 to 55 HP

Lorain diesel or gas engines are built with an extra margin of stamina to stand up to gruelling service. Simple 2-cycle, single-cylinder design reduces moving parts for dependability. They operate as cold-starting diesels or can be converted easily and quickly in the field for natural gas or butane.

Get full details on Lorain Multi-Fuel Engines. *They operate longer without attention . . . operate longer between overhauls.* Write for specifications today.

A-5073

WHITE-ROTH Machine Corp. LORAIN, OHIO

Growth of ASTM specifications was noted, from the first 10 issued in 1900, to the present 1900. There was also a shift in the ratio of standards on metals to non-metals, from 4 to 1 in favor of metals in 1912, to about 1 to 2.7 today in favor of non-metallic standards.

About 150 American and Canadian technical and scientific societies, trade associations and related groups, branches of the Federal government, and many from overseas were officially represented at the meeting. It was announced that the 1953 annual meeting of the society would be held in Atlantic City next year.

Technology Is Answer To Labor Shortage

The nation must rely more on industrial instrumentation and other technological developments to offset the imbalance between the number of workers and consumers, according to R. A. Schlegel of Minneapolis-Honeywell Regulator Co.

Speaking before the petroleum section at the semi-annual meeting of the American Society of Mechanical Engineers, he said that because workers are retiring earlier and less people are entering the labor force due to the low birth rate of the thirties and the military service for youth, the labor force will remain almost constant until 1960 while the population rises to 182 million. By 1953, he claims, we'll need a million more workers than will be available.

He cited the petroleum industry as an example, where centralized instrumentation has advanced to a stage where technicians have at their fingertips the means for controlling huge processes necessary to that industry, and that other industries must follow in this population vs production problem.

Crude Oil Powers Booster Diesels

Boosting crude oil pressure in a Richfield Oil Corp. transmission pipeline running through the Cuayama Valley in California, is the job of three National Supply Co. Atlas diesels. Each of the three pumps, which are piped in series, is driven by a Model 45, 8-cyl, 4-cycle engine using crude oil for fuel and developing 320 hp at 600 rpm.

The small amount of wear evidenced by figures shown in inspection records indicates that the crude oil fuel is satisfactory from an abrasive standpoint. The crude is centrifuged, but not heated. Lubricating oil is heavy duty SAE-30.

Regular spot testing of equipment includes checking the condition of lube oil and specifying when it is to be changed. Oil changes depend upon its condition and vary from 335 to 1329 hours of operation.

A general average of 500 operating hours for the engines, in the period from June 1951 to March 1952, indicates .001 to .003 liner wear and .00025 flywheel deflection.

Two New Offices For TOCCO

The TOCCO division of the Ohio Crankshaft Company of Ohio announces the opening of a west coast office in Los Angeles. It will offer complete engineering, sales and service

facilities for the company's induction heating equipment.

The company's Chicago office has moved to larger quarters, with addition of a new laboratory equipped for experimental work on induction heating applications.

Light Diesel Tractor

A newcomer to the diesel field is Reo Motors, Inc. of Lansing, Michigan, which has come out with a tractor model it claims to be one of the lightest on the road in its class. The model, F-23DT, is a high-speed truck-tractor powered by the lightweight Cummins JBS-600 diesel engine.

A specially designed chassis in combination with the new high-compression engine gives the diesel operators weight advantages in comparison with competitive makes, according to the company. The chassis and cab with 20 gal of fuel and all tractor equipment, except the fifth wheel, weighs about 9475 lb. The model has a gross tractor weighting of 50,000 lb and a 130-in wheelbase.

The four-cycle engine develops 150-hp. at a governed speed of 2500 rpm, and 360-ft lb of torque at 1400 rpm. Weight of the complete plant is 1825 lb, which includes clutch and transmission.

The six-cyl, valve-in-head engine, has a displacement of 401 cu in. a 4⅛ by 5 in bore and stroke, and a compression ratio of 15.1. The engine has replaceable, wet cylinder sleeves, a seven-bearing crankshaft, and full-pressure lubrication.

Nationalist China To Send Two Official Delegations To Centennial of Engineering

The Nationalist Chinese government will send two official delegations from its headquarters on Formosa to the Centennial of Engineering to be held in Chicago this summer, it was learned. This makes 16 foreign nations that will be represented by their leading scientists and engineers.

One of the Chinese groups will represent the Chiang Kai-shek Ministry of Economic Affairs, which will be headed by the chairman of the board of the Chinese Petroleum Corporation. The second group will represent the Chinese Institute of Engineers.

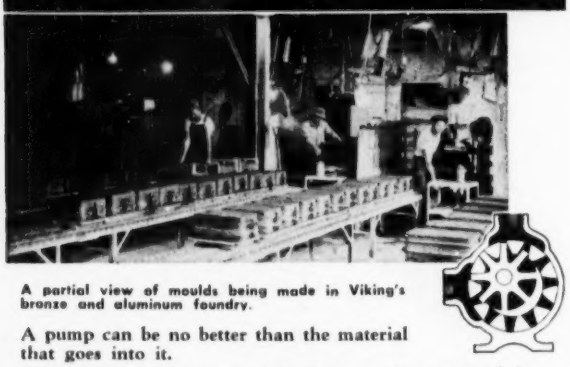
Lenox R. Lohr, president of the Centennial, announced that South America will send 150 to the celebration. They will come for the international convocation, scheduled for September 3-13.

Canadian Subsidiary For English Diesel Manufacturers

F. Perkins Ltd., Peterborough, England manufacturers of diesel engines, have established a Canadian subsidiary, to handle sales and spare parts distributions. Headquarters of the new subsidiary, to be called F. Perkins (Canada) Ltd., will be in Toronto.

Company service personnel have been active in Canada since 1950, con-

WHAT MAKES VIKING A BETTER PUMP?



A partial view of moulds being made in Viking's bronze and aluminum foundry.

A pump can be no better than the material that goes into it.

All Viking pumps are made from castings poured in our own rigidly controlled Sorbo-Mat foundries.

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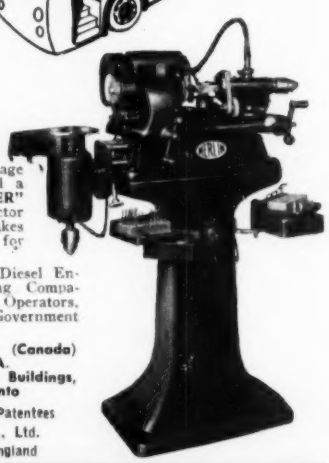
IN FIVE MINUTES in your own shop or ship it will make your diesel injector nozzles and needles like new. It will grind a point dead concentric with another portion and maintain a predetermined angle to within a minute of a degree.

It will enable you to operate your diesel engines at maximum efficiency all the time.

It will cut your fuel costs.

It will pay the operator's wage in one hour. If you install a "MERLIN SERVICEMASTER" you can recondition fuel injector nozzles in less time than it takes to pack them to send away for repairs.



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The demand for Automatic Standby Power has increased from year to year due to the savings afforded. Now, with the imminent possibility of bombing our cities and disrupting essential services the need has greatly increased and deserves the serious consideration of all power users.

For the past twenty years, SYNCHRO-START has made controls to automatically start and stop these power plants according to power demands and to protect them against abnormal conditions.

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Get BETTER Control with POWERS FLOWRITE VALVES

VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

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BONNET ASSEMBLY—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES
Sizes ½" thru 8"
For line pressures below 250 psi. Rugged construction to withstand piping strains.
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Reduce Maintenance with FLOWRITE VALVES

THE POWERS REGULATOR COMPANY
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centrating on a mobile diesel engine school.

The school, one of six operated by the parent company throughout the world, is soon to start on its third trans-Canada trip. It is composed of a 23,000-lb. demonstration vehicle with two sectionalized diesel engines mounted on it. Driver-instructors give complete diesel engine courses to car dealers and technical schools across Canada.

Antique Truck Presented To Museum

A 1911 Mack truck was recently presented to the Long Island Automotive Museum. The two-ton truck, the oldest in the museum built by a firm that is still in business, arrived under its own power.

Preceding the ceremony, a cavalcade of ancient automotive vehicles led by the 41-year-old truck paraded through Southampton, the museum's site. The truck, valued at $25,000, was driven by the man who serviced the truck when it was originally sold.

It was explained that the truck was first sold in 1911 to a farmer, who turned in a horse as part payment. The driver had to ride the horse back to his company, bareback, as a saddle was not included in the deal.

Buehler, Inc. Buys Pickering

Pickering Governor Company has been acquired by Buehler, Inc. of Paramus, N. J., specialists in precision machining. The acquisition will constitute the largest part of the Buehler activities and therefore, governor manufacture will receive preference over everything else.

Current attention will be focused on plant and tooling readjustments, so as to insure the highest quality workmanship and general efficiency. Retooling will take place wherever it is found to be necessary. In addition to the manufacturing phase, attention will be focused on governor development and improved techniques to provide parts interchangeability.

Service and delivery are recognized as major requirements. Analysis of current orders is being made in the light of organizational changes and improvements in plant and techniques to speed delivery time. A survey is also underway to determine methods to insure adequate service facilities.

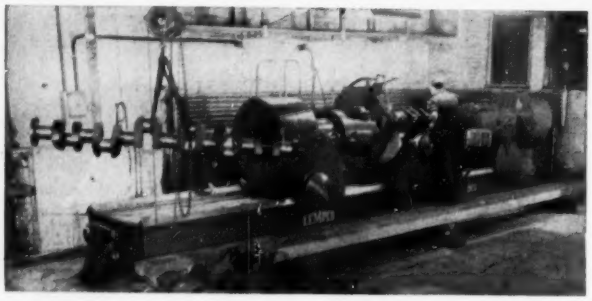
General Electric Equipment For Kaiser Aluminum Plant

Eight million dollars worth of General Electric apparatus is being installed at the Chalmette (La.) reduction plant of the Kaiser Aluminum and Chemical Corporation. This brings the total value of the company's equipment in the plant to $21,000,000.

The expansion in equipment will double the plant's capacity from 200 million to 400 million lbs of aluminum a year, in line with plans to increase the industry's over-all production to 2½ billion lbs annually.

Experimental Stress Meeting

The Society for Experimental Stress Analysis announces that its annual meeting and exhibition will be held at the Hotel McAlpin in New York City on December 3, 4, and 5.



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Recent installation of the NEWEST and LARGEST crankshaft grinder in a jobbing shop.

WORN, BENT OR BROKEN CRANKSHAFTS
Built up by metallizing
and ground to factory
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Ground undersize.
Thermit welded.
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LARGE CRANKSHAFTS OUR SPECIALTY
Complete facilities for Diesel
Engine repairs.

BRODIE SYSTEM 115 Clifton Place, Brooklyn 5, N.Y. Phone Main 2-5242

Cummins Expansion Program Half Completed

The second phase of the Los Angeles plant expansion program of the Cummins Service and Sales, southern California engine dealers, is now under way. The first phase, revamping a building into an engine and parts warehouse, has been completed.

The expansion includes the erection of a new shop building adjoining the present engine rebuilding department and the erection of a new building to house additional dynamotor and engine testing facilities. In addition, the present parts and office building will be enlarged and altered.

Mobile Lubrication Truck

In an effort to greatly reduce downtime on fire trucks and other related vehicles, the New York City Fire Department has recently put into service a mobile lubrication truck.

Still in the experimental stage, the truck is manned by two men and a lieutenant. The truck is equipped with a portable air compressor and latest high pressure lubrication apparatus. Previously only hand grease guns were used as no high pressure equipment was available in the firehouses.

Petroleum Project Set Up

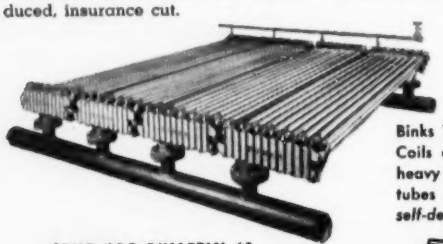
A program of work has been agreed upon by a group of 32 petroleum ex-

1/16"

BIG LOSS
if engine heat
travels this little extra distance!

*A 1/16 in. thick deposit of calcium carbonate in the jacket of an engine hinders heat transfer to the cooling water as much as 3-3/16 in. of cast iron.** That's why scale deposits mean poor cooling...decrease engine efficiency.

With Binks closed type heat exchange coils (installed in a Binks cooling tower), you can economically use soft or treated water for cooling purposes. You simply circulate it through a closed system from jacket to coil and back. No scale forms, breakdowns are reduced, insurance cut.



Binks Type "D" Coils are built of heavy 1" O.D. copper tubes and are *self-descaling*

SEND FOR BULLETIN 41
Gives complete details, drawings and tables of heat exchange coils adaptable to a variety of diesel operating conditions.

*Courtesy, D. W. Haering and Co., Inc.

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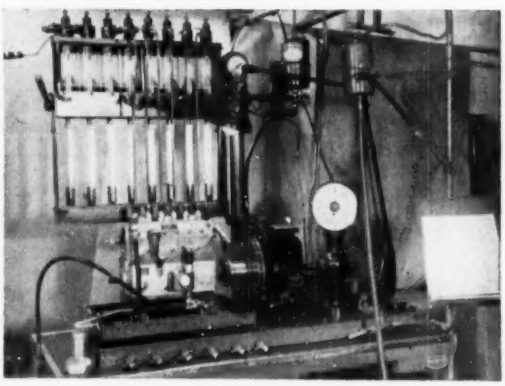

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These Diesel Lubricating Pumps
Nos. 53 & 55
ROTARY GEARED PUMPS
with Helical Gears
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. . . " grow old GRACEFULLY"

HERE ARE exceptionally long-lived, efficient pumps for your diesel's pressure lubricating system up to 200 p.s.i. Nos. 53 & 55 Brown & Sharpe Rotary Geared Pumps have very accurate helical gears and roller bearings . . . provide smooth flow at high speeds. Leakage is prevented by mechanical seal . . . no glands to wear out. Their long, trouble-free performance is proved in thousands of diesel installations. Available with capacities from 4 to 34.1 g.p.m. at 0 lbs. pressure. Write for complete Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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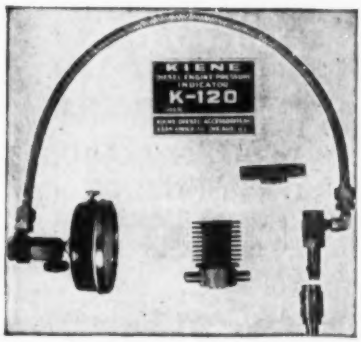
KIENE MODEL K-120 UNIVERSAL PEAK PRESSURE INDICATOR



Model K-120 with cooler body and nozzle dummy.

MODEL K-120 Indicator has but one moving-part—nothing to wear or get out of adjustment.

VALVE—Gas trap type with diaphragm type check valve having adjustable lift. Stainless steel valve and seat.

No springs—No pistons—no complicated adjustments — No temperature corrections — no pressure loss in check valve.

GAGE READS TRUE PRESSURE—MAY BE RECALIBRATED ON ANY GAGE TESTER

Check readings can be made over and over again by releasing indicated pressures with bleeder valve.

GAGE—Hydraulic 3½ inch dead weight tested in suitable range to specification requirements.

ADAPTORS available for most models of engines manufactured in U.S.A. Other models made to order at reasonable prices.

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Dependable — Easy to Use — Rugged. May be Used With or Without Flexible Tube.

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perts from 11 nations, for developing a system of international standards for measurement and testing of petroleum and petroleum products, the American Standards Association announces.

Listed for immediate study are the standardization of oil measurement tables, an internationally accepted method for determining the knock ratings of motor fuels, development of equivalent terminology for petroleum products, and the standardization of temperatures used in determining viscosity.

Allis-Chalmers New Building

A modern one-story fireproof building is being constructed for the Kansas City branch of Allis-Chalmers, near Independence, Mo., in the new industrial area now under development by the Gulf, Mobile and Ohio Railroad.

Steel Alligators In Wyoming

Steel alligators are being used in Wyoming in clearing timber land. The mechanical alligators have bulldozer bodies and pointed snouts with saw teeth on both edges.

A single alligator with a saw made of high carbon steel can clear up to five acres in eight hours. The machines are being used to clear 12,722 acres of rugged timber land for a reservoir. The project will bring irrigation and electricity to 100,000 acres of fertile valley soil near the busy western town of Thermopolis, Wyo.

Diesel Locomotive Use Increases

In the first five months of this year, 1142 new diesel locomotives were placed in service, in contrast to 1048 diesels in the first five months of last year, the Association of American Railroads announced recently.

During the period from May 23 to June 18, the Canadian Pacific Railway completed an order for ten 1500-hp freight and passenger diesel "B" units equipped with steam generators. Three 660-hp diesel switchers, and one 1500-hp freight diesel "B", units were also added, completing an order for 12.

Water Conditioning Co. Expands

Because of steadily increasing business, the Graver Water Conditioning Co., which moved from Chicago to New York three years ago, has doubled its office space.

The company is a division of the Graver Tank & Mfg. Co. and was established more than 40 years ago. It manufactures equipment for all water-conditioning processes, in four large plants, and maintains engineering sales offices throughout the country.

Oil Progress Week

The 1952 observance of Oil Progress Week, sponsored by the American Petroleum Institute, has been set for October 12-18.

Organizational News

Cummins Changes

Harold H. Hall, formerly general service manager of Cummins Engine Company, Inc. is now general manager, Cummins Diesel Export Corporation, with headquarters also at Columbus, Indiana. He is succeeded by Charles C. Sons, formerly eastern service manager.

Mr. Hall joined the company in

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PREMAX
PRESSURE INDICATOR
for DIRECT-READING
of COMPRESSION AND
FIRING PRESSURES
OF EVERY TYPE OF DIESEL ENGINE
ONE OF THE FEATURES
Responsible for Its Overwhelming
Preference by Leading Diesel
Manufacturers and Operators
Successive readings may be taken rapidly since no venting of the instrument is required between readings. No closing of valves required to change from firing pressure to compression pressure reading.
For other features, write for Bulletin 294
ACCURATE PRESSURE READINGS
as high as 1700 P.S.I.
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1938 as service representative in the southeastern region. From 1940 to 1942 he was service and parts manager of the dealership at Memphis Tennessee. During the war years he served in the Navy.

Returning from service in 1945, he became a field service representative and in 1947, manager of the St. Paul, Minnesota dealership. In 1948 he became general service manager at Columbus.

Engineers Install President

Herbert F. Roemmele was recently installed as president of the N Y Chapter of the New York State Society of Professional Engineers at their annual meeting.

Professor Roemmele has been on the faculty of Cooper Union's School of Engineers for 25 years. He is a professor of mechanical engineering and dean of students. Prior to his appointment there, he worked as a test engineer for the General Electric Company.

For the past 18 years, he has been active in the professional engineering movement. He is a member of the

PROFESSOR ROEMMELE

American Society of Electrical Engineers, American Society of Mechanical Engineers, and is author of "Mechanical Engineering Laboratory Manual."

Veeps for National Carbon

P. M. Buhrer and C. O. Kleinsmith have been appointed executive vice presidents of National Carbon Company, a division of Union Carbide and Carbon Corporation.

Mr. Buhrer, born in Tiffin, Ohio, entered the company in 1923 as a development engineer in the research division. He is a graduate of Johns Hopkins.

Mr. Kleinsmith joined the organization in 1914, in the sales division. He was born in Cleveland, Ohio, and attended Case Institute of Technology.

Manager for Nat'l Electric

C. Wesley Merritt has been placed as sales manager of the newly organized railroad department of National Electric Products Corp., Pittsburgh.

Mr. Merritt will coordinate sales of the company's wires, cables, conduits, raceways, and accessories for installation in railroad rolling stock and diesel maintenance shops. He is a graduate of the University of Pittsburg and has been with the company since 1940.

Rock Island Appointees

F. R. Hosack has been appointed general superintendent of the car department, and F. J. Schleihs has been given the post of general superintendent of motive power, on the Rock Island Lines.

Mr. Hosack has been an official in the railroad's operating department since 1949. Mr. Schleihs began his career with the company as a machinist in 1916.

Alcoa Changes

Frank L. Magee has been elected a director of the Aluminum Company of America, by action of the board of directors. J. R. D. Huston retires as secretary, and Alfred M. Hunt has been named to succeed him.

Mr. Magee's elevation comes after 34 years with the company. Following graduation from Lehigh University, he started with the company as a sales apprentice in 1917.

Mr. Huston came to Alcoa in 1918, after 13 years of law practice in Pittsburgh. Mr. Hunt, who assumes his position, came to the company in 1942; his first position was as a technical apprentice. He became a member of the board of directors in 1949.

GE Engineering Manager

Dr. Robert H. Krieble has just been promoted to the position of manager of engineering for the chemical materials department of the General Electric chemical division.

He joined the company's research laboratory in 1943, transferring from Socony-Vacuum, and in 1946 was sent to Europe to study the German methods of producing plastics intermediates. Just before his present appointment, he was engineer of the company's Thomson laboratory.

Farr Appoints

Four new manufacturers' representatives have been appointed by Farr Company of Los Angeles, manufacturers of filters. They are as follows:

Donald Southard of Denver will cover the Colorado and Wyoming territory.

F. W. Jenike Company of Cincinnati for the Cincinnati trading area and the state of Kentucky.

The Charlie Wood Company of Columbus for Columbus, Dayton, Mansfield and Coshocton trading areas.

The William M. Shank Company of Indianapolis in southern Indiana.

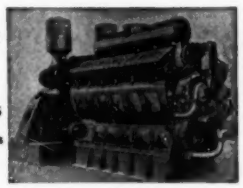
Managers for Westinghouse

The Westinghouse Meter division announces two managerial appointments. S. C. Leyland has been named manager of engineering, and William K. Sonnemann, relay engineering manager.

Mr. Leyland joined the company in 1925. From 1941 until his new appointment, he was manager of the relay engineering section. Mr. Sonnemann held the post of relay design engineer, until his new appointment.

DIESEL ELECTRIC POWER

for IMMEDIATE SHIPMENT
Unit Capacities 100 to 1875 Kva A.C. 50-60 Cycles Various Voltages



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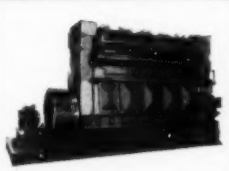

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Superior Heavy Duty Diesel Engine

510 H. P. at 360 R. P. M., 5 cylinders, 4 cycles, 14½ x 18, type ZDSB. Non-reversing, vertical, with cold starting and mechanical injection. Engine totally enclosed. For dredge pump service and general pumping duties.

The Boston Metals Co.
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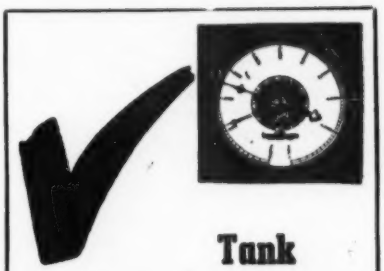

Tank Contents At A Glance

With Liquidometer remote reading fuel storage tank gauges you can check quickly and accurately oil deliveries, consumption and amount on hand. No Diesel plant is complete without one. Liquidometer or Levelometer models are available for tanks of any capacity.

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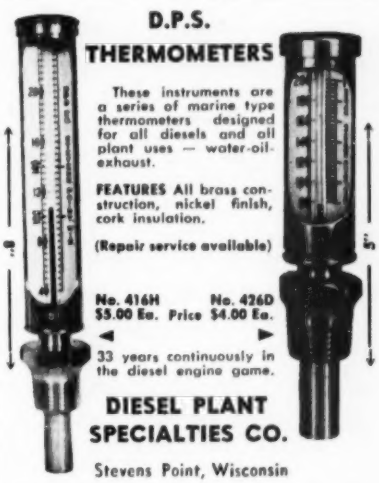
THE LIQUIDOMETER CORP.
36-24 Skillman Ave., Long Island City, N. Y.



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FEATURES All brass construction, nickel finish, cork insulation.

(Repair service available)

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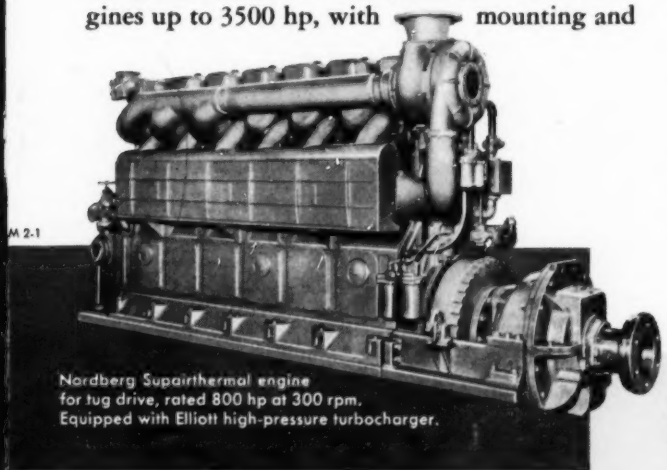

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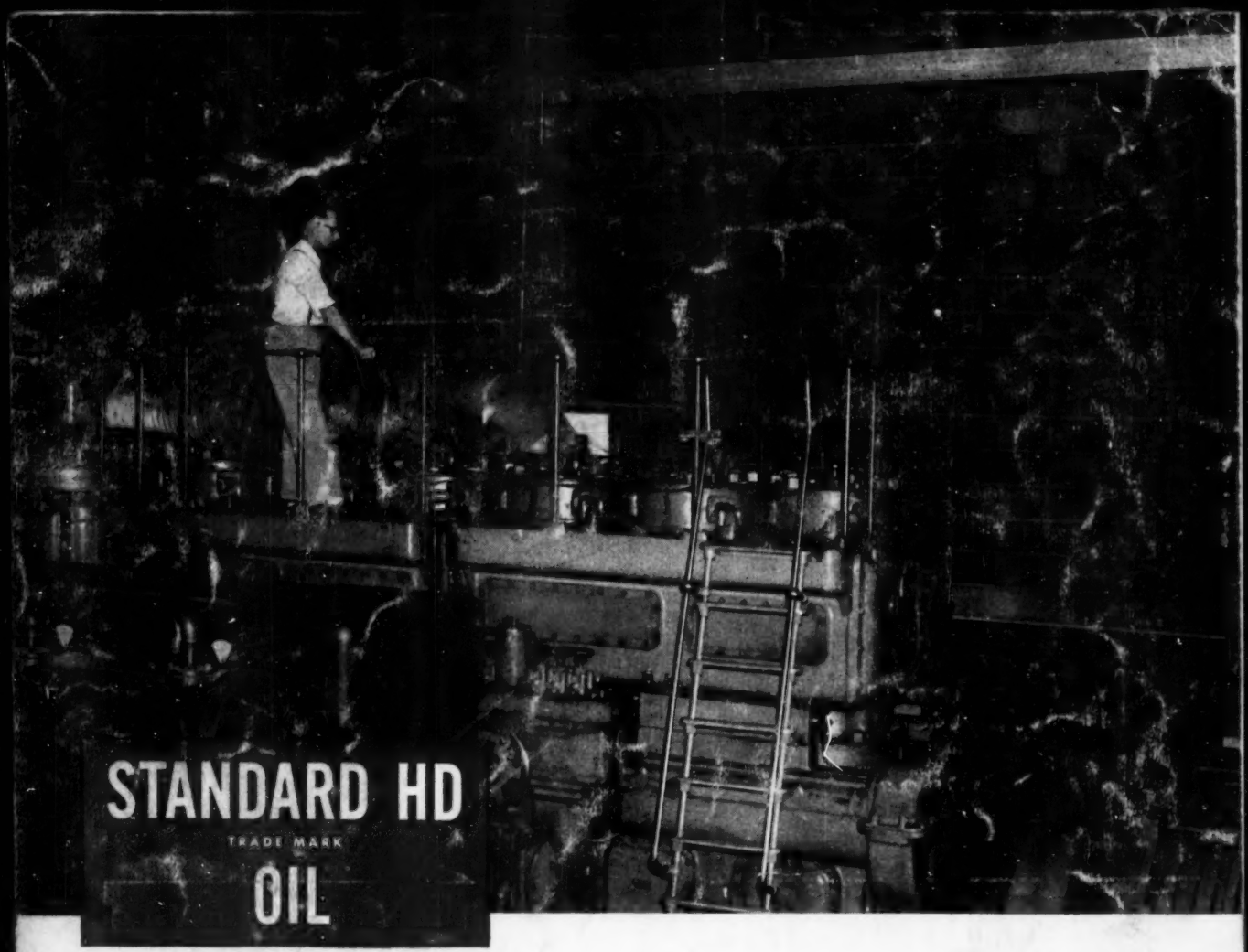

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Ring sticking, ring breakage, and carbon deposits have been eliminated.

Ring replacements have been reduced from 80 to 18 per year. Cylinder wear has been cut from .003" per 1000 hours to a maximum of .003" per 5000 hours.

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Lubricant consumption, formerly averaging one gallon per 1192 KW generated, now averages one gallon per 1535 KW generated. Fuel consumption, which had averaged 12.28 KW per gallon, now averages 13.50 KW per gallon.

A Standard Oil lubrication specialist can help you develop a similar "before and after" situation in the operation of your own diesels. For his services, and his recommendations, simply call the Standard Oil Company office in your own area. Or write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Illinois.

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